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ABSTRACT

This document contains the proceedings of the National Educational Computing Conference (NECC) 2001. The following research papers are included: "UCI Computer Arts: Building Gender Equity While Meeting ISTE NETS" (Kimberly Bisbee Burge); "From Mythology to Technology: Sisyphus Makes the Leap to Learn" (Patricia J. Donohue, Mary Beth Kelley-Lowe, and John J. Hoover); "Simulations in the Learning Cycle: A Case Study Involving Exploring the Nardoo" (William M. Dwyer, Valesca E. Lopez); "Connecting across Many Divides: Digital, Racial, and Socio-Economic" (Janice Hinson and Cathy Daniel); "Educational Technology Professional Development Program" (Karen S. Ivers); "The Impact of an Innovative Model of Technology Professional Development" (Vivian Johnson); "Middle School Students as Multimedia Designers: A Project-Based Learning Approach" (Min Liu and Yu-Ping Hsiao); "Evaluation of a Laptop Program: Successes and Recommendations" (Deborah L. Lowther, Steven M. Ross, Gary R. Morrison); "E-Pals: Examining a Cross-Cultural Writing/Literature Project" (Lauren G. McClanahan); "Web-Based Computer Supported Cooperative Work" (John E. McEneaney and others); "Adapting Online Education to Different Learning Styles" (Diana J. Muir); "Enhancing Elementary Students' Creative Problem Solving through Project-Based Education" (Romina M. J. Proctor); "Effective Teaching Styles and Instructional Design for Online Learning Environments" (Ian J. Quitadamo and Abbie Brown) "Teaching and Learning with Information and Communication Technology: Success through a Whole School Approach" (Grant Ramsay); "Cross-Country Conversations: Techniques for Facilitating Web-Based Collaboration" (Julie Reinhart, Joe Slowinski, and Tiffany Anderson); "Fostering Girls' Computer Literacy through Laptop Learning: Can Mobile Computers Help To Level Out the Gender Difference?" (Heike Schaumburg); "Commonalities in Educational Technology Policy Initiatives among Nations" (James Schnitz); "Building Awareness of Text Structure through Technology"

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(Edith A. Slaton); "Assessing New IT Workers: Adult Women and Underrepresented Minorities" (Karen Spahn); "Constructionism as a High-Tech Intervention Strategy for At-Risk Learners" (Gary S. Stager); "The Evolving Role of School-Based Technology Coordinators in Elementary Programs" (Neal Strudler, Christy Falba, and Doug Hearrington); "Building Positive Attitudes among Geographically-Diverse Students: The Project I-57 Experience" (Paul A. Sundberg); "A Model for Pedagogical and Curricula Transformation with Technology" (David R. Wetzel); and "A Picture of Change in Technology-Rich K8 Classrooms" (Keith Wetzel, Ron Zambo, Ray Buss, and Helen Padgett). Post-conference presenter handouts and the conference program are also included. (MES)

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2001
CHICAGO
NECC

Thanks for a Great Conference!

Post-Conference Facts

Audiotaping Order Form

Presenter Handouts are available.

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See you next year in San Antonio for NECC 2002 !

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General Information

Conference at a Glance

Program Including Keynotes, Workshops and Sessions

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NECC 2001 Program

last modified;
10/18/01

Welcome!

The Program Committee congratulates all who participated in NECC 2001—both the expert presenters who shared their experiences in sessions and workshops, and the dedicated teachers and other professionals who attended the conference to improve their knowledge of educational technology.

The Committee worked throughout the year to bring you the broadest, most inspiring, and useful program possible, and trusts that you enjoyed many valuable learning and sharing opportunities during the conference.

Be sure to browse through our Presenter Handouts and Research Papers sections to continue building on the knowledge foundation you established at NECC 2001!

Louis Gomez, Helen Hoffenberg, & Anita McAnear
NECC 2001 Program Co-chairs

The NECC 2001 Program Features:

Keynotes

Designed to inspire and educate, Keynotes are offered once at the beginning of each conference day, at the closing session, and at the conference luncheon.

Workshops

Offered before and during the conference, Workshops are designed to provide more in-depth exploration of specific issues and topics.

Final Program PDF's

Plans for NECC 2002 are under way!

Future NECCs

Site Map

Available in 3-, 6-, and 12-hour (two-day) segments in both hands-on and seminar/demo formats, Workshops require additional fees and advance registration.

Make & Take Sessions

These two-hour sessions offer hands-on activities to small collaborative groups aimed at learning to use technology to create a product or project that participants can then take home. Enrollment is limited to one session per person. Additional fee ($10) and advance registration are required.

Concurrent Sessions

Offered in one-hour panel, team, or individual formats, Concurrent Sessions highlight the successful programs, projects, ideas, and concepts of educators from all levels. Spotlight Sessions are a special category of Concurrent Sessions and feature recognized leaders in the educational technology field.

Research Papers

Offered as part of the Concurrent Sessions, Paper sessions feature two peer-juried original research papers per one-hour time slot, on the general theme of using technologies to enhance education.

Posters & Web Poster Sessions

These two-hour sessions allow participants to engage in one-on-one or small-group discussions featuring both hard media and electronic displays. Web Posters include the enhancement of Internet connectivity. Attendees can view 12 Poster and 12 Web Posters at each time block.

Student Showcases

In these two-hour sessions, students and teachers demonstrate how they use technology in their classrooms.

Program Themes

- Building A Framework
- Building Technology Capacity
- Building Human Capacity
- Building A Learning Environment
- Building Equity And Accountability

Workshop Strands

- Computer Networking & Systems
- Content-Area Specific Curriculum Integration
- Ed Tech Leadership
- Issues of Diversity/ Special Needs
- Multimedia
- Professional Development
- Project-Based Learning
- Skill Building
- Standards & Assessment
- Web-Enhanced Instruction
- Web Page Design

What is NETS?

NETS stands for ISTE's National Educational Technology Standards projects. NETS defines what students and teachers should know and be able to do with technology. ISTE worked with a broad coalition of educators, curriculum associations, and other educational organizations to develop and come to consensus on these standards. For more information on NETS, see www.iste.org.

Look for the following NETS classifications following NECC workshops listing in this program and on the NECC Web site whenever applicable.

NETS for Students (NETS°S) are organized into the following categories:
1. Basic operations and concepts
2. Social, ethical, and human issues

3. Technology productivity tools
4. Technology communications tools
5. Technology research tools
6. Technology problem-solving and decision-making tools

NETS for Teachers (NETS°T) are organized into the following categories:

i. Technology operations and concepts
ii. Planning and designing learning environments and experiences
iii. Teaching, learning, and the curriculum
iv. Assessment and evaluation
v. Productivity and professional practice
vi. Social, ethical, legal, and human issues

NECC 2001 Research Papers

last modified;
8/7/01

NECC 2001 accepted 25 research papers. The research papers are presented two to a time slot as part of the concurrent sessions.

The titles and authors are listed below alphabetically by the main author's last name. If you click on a title, the page will scroll down to the abstract for that paper. Then if you click on "view abstract .pdf", you can view the Adobe Acrobat PDF of the paper.

UCI Computer Arts: Building Gender Equity While Meeting ISTE NETS

Kimberly Bisbee Burge, Ed. D.

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Simulations in the Learning Cycle: A Case Study Involving *Exploring the Nardoo*

William M. Dwyer, Valesca E. Lopez

Connecting Across Many Divides: Digital, Racial, and Socio-Economic

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Jim Kerlin
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William F. Lyle, III
Kim MacGregor
Matt Manweller
Anita McAnear
Steven McGee
Diane McGrath
Michael McVey
Carroll Melnyk
Cindy Meyer Hanchey
Keith Miller
Dale Nieaderhauser
Maggie Niess
Kwi Park-Kim
Dawn Poole
Rose Reissman

Janice Hinson, Cathy Daniel

Educational Technology Professional Development Program

Karen S. Ivers, Ph.D.

The Impact of an Innovative Model of Technology Professional Development

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Middle School Students as Multimedia Designers: A Project-Based Learning Approach

Min Liu, Yu-Ping Hsiao

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E-Pals: Examining a Cross-Cultural Writing/Literature Project

Lauren G. McClanahan

Web-Based Computer Supported Cooperative Work

John E. McEneaney, Ph.D.; Co-authors: Wendy M. Subrin, Homa Roshanaei, Bryan Baroni, and Ledong Li

Adapting Online Education to Different Learning Styles

Noel Schiro Bitner
J. Fred Schouten
Robert Seidman
Charles Shub
Peter Soreanu
Dennis Spuck
Leslie Thyberg
Michelle Tressel
John Vaille
Roberta Weber
Keith Wetzel
Evye Woldman

If you are interested in becoming a paper referee for NECC 2002 in San Antonio, Texas, June 17-19, or for future NECC's, please contact Program Co-Chair, Anita McAnear, 541.346.2400 or e-mail program@neccsite.org.

Diana J. Muir, Ph.D.

Enhancing Elementary Students' Creative Problem Solving through Project-based Education

Romina M. J. Proctor

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Ian J. Quitadamo; Abbie Brown, Ph.D.

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A Picture of Change in

Technology-rich K-8 Classrooms

Keith Wetzel, Ron Zambo, Ray Buss, Helen Padgett

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UCI Computer Arts: Building Gender Equity While Meeting ISTE NETS

Kimberly Bisbee Burge, Ed. D.

Key Words: elementary, gender, constructivism, multimedia learning activities

Multimedia computer learning activities, when designed according to what we know about children's preferences, may help close the so called" gender gap" in attitudes about computer usage in schools. This paper includes a brief overview of gender-gap research, a description of one response: the UCI Computer Arts program (aligned with ISTE NETS: National Educational Technology Standards for Students), and the author's dissertation research: 410 coded observations of 76 4th and 5th grade students over six weeks while they worked in same and mixed sex pairs on multimedia learning activities. The study revealed that females were as active, if not more so than males, when they were involved in constructivist, cooperative, curriculum based, multimedia learning activities, and both groups were more active in same-sex pairings.

June 26, 2001; 4:30-5:30 pm; Room: S504a
Discussant: Carolyn Knox

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From Mythology to Technology: Sisyphus Makes the Leap to Learn

Patricia J. Donohue, Mary Beth Kelley-Lowe, John J. Hoover

Key Words: Professional Development, Web Instruction, Technology Training, Instructional Technology, Constructivist

Making the leap to a technology-enhanced, online educational experience has been a four-year labor of love as well as a steep learning curve for the NatureShift! Linking Learning to Life project. A five-year U.S. Department of Education Technology Innovation Challenge Grant (TICG), the NatureShift (NS) project was awarded in 1997 to the partnership of Dakota Science Center and the Grand Forks Public Schools. It was designed with partners from the Sahnish Cultural Society and the University of North Dakota to take technology and hands-on learning to an information-isolated highway of communities including public schools, tribal schools, parks, museums and libraries. It soon became a true test of mettle for learners, educators, community volunteers, and instructional designers alike. This paper will discuss lessons learned from the project's first three years of training educators in the application of the NatureShift Exploration Model, a teaching and learning strategy that borrows heavily from informal education, formal education and instructional technology.

June 27, 2001; 12-1 pm; Room: S504a
Discussant: Bob Tinker

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Simulations in the Learning Cycle: A Case Study Involving *Exploring the Nardoo*

William M. Dwyer, Valesca E. Lopez

Key Words: simulation, learning cycle, constructivism, environment, science education

This study involved students using simulation software in all phases of the learning cycle. Research on the use of simulations in science education has shown that the simulations can be used effectively in preinstructional (Hargrave & Kenton, 2000; Gokhale, 1996) and exploratory activities (de Jong & van Joolingen, 1998). Preinstructional and exploratory activities elicit and challenge students' alternative conceptions. Having set the context for formal instruction, simulations then can be used to learn new concepts in the invention phase of the learning cycle. With the specific guidance in simulations such as Exploring the Nardoo (Harper & Hedberg, 1996, 1997), students perform better (Lee, 1999). Simulations can be used again to apply newly learned concepts in different contexts in the expansion phase of the learning cycle.

June 25, 2001; 2-3 pm; Room: S504a
Discussant: Ricky Carter

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Connecting Across Many Divides: Digital, Racial, and Socio-Economic

Janice Hinson, Cathy Daniel

As Internet usage increases nationally, it becomes more apparent that the Digital Divide‹the gap between those who have information access and those who do not‹is related to demographics. Although the number of low income and ethnic households that have Internet access is increasing, the Digital Divide is expected to widen because access continues to be tied to income. WISH‹WorldGate Internet School to Home‹gives students, parents and teachers Internet access through a television set and a cable set-top converter. No computer, modem or telephone line is needed. In this way, WISHTV is unique because it allows users to access the Internet through their television sets and as a result, extends Internet availability to virtually all children in their homes. This is especially important for students whose socio-economic status inhibits Internet access through any other means. This article focuses on the implementation of WISH TV in the community of Belle Rose, Louisiana.

June 27, 2001; 3-4 pm; Room: S504a
Discussant: David Raker

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Educational Technology Professional Development Program

Karen S. Ivers, Ph.D.

Key Words: training, proficiencies, CSU, CTAP, self-perception

The California Governor's budget for 2000-2001 included an appropriation to the California State University (CSU) system of $6,500,000 for intensive K-12 staff development on the use of technology in the K-12 classroom. This funding was intended to enable new and experienced teachers, teamed with their site administrators, to expand their knowledge and expertise in using technology in their classrooms to improve student achievement. The CSU was asked to coordinate and administer this important aspect of professional development. To initiate the process, the CSU established the Educational Technology Professional Development Program‹a program designed to encourage institutions of higher education and K-12 organizations to work together to help teachers use technology in their classrooms. This program is intended to help teachers reach the highest level of competency in the Instructional Technology portion of the Teacher Computer-Based Technology Proficiencies, as developed by the California Technology Assistance Project (CTAP) Proficiency Committee.

June 25, 2001; 11 am-12 noon; Room: S504a
Discussant: Kyle Peck

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The Impact of an Innovative Model of Technology Professional Development

Dr. Vivian Johnson

This paper describes participant reaction to an informal field test of the Identifying Changes, Exploring Possibilities, and Developing Technology Skills (ICED) Professional Development Model. The theoretical framework for the ICED model is drawn from three sources:

- literature review of the change process, specifically the adoption of innovation; best practices for the professional development of teachers; and the integration of technology in the professional practice of teachers;
- direct experience with the design, delivery, and assessment of technology-related professional development for K-16 teachers;
- reflective dialogue regarding the conditions which are necessary for me to integrate technology in a substantive way in my own professional practice.

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Middle School Students as Multimedia Designers: A Project-Based Learning Approach

Min Liu, Yu-Ping Hsiao

Key Words: Multimedia design, project-based learning, cognitive skills, motivation, and constructivism

This presentation reports a research practice of engaging middle school students to be multimedia designers using a project-based learning approach. Specifically, it addresses two questions; (1). Can a learner-as-multimedia-designer environment increase middle school students' motivation toward learning? (2). Is the middle school students' cognitive strategy use affected by engaging in the role of being a multimedia designer? The paper describes this learner-as-multimedia-designer environment in detail (the various phases, tasks, and tools). Both quantitative and qualitative data were used in the investigation. The results suggested that such an environment encourages the students to be independent learners, good problem solvers, and effective decision-makers. Engaging middle school students in being a multimedia designer can have positive impact on their cognitive strategy use and motivation.

June 26, 2001; 1:30-2:30 pm; Room: S504a
Discussant: Jeremy Roshelle

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Evaluation of a Laptop Program: Successes and Recommendations

Deborah L. Lowther, Steven M. Ross, Gary R. Morrison

Key Words: laptops, technology integration, classroom practices

The overall purpose of this evaluation study was to determine the effectiveness of providing 5th and 6th grade students in

Walled Lake Consolidated Schools (WLCS) with access to laptop computers with regard to classroom learning activities, technology usage, and writing achievement. The WLCS Laptop Program is based on the Anytime Anywhere Learning (AAL) program (AAL, 2000), which has been in schools since 1996 and has impacted more than 100,000 students and teachers. The goal of the AAL program is to provide students the knowledge, skills and tools to learn anytime and anywhere. The Laptop Program classrooms were equipped with wireless access to the Internet and printers. The program also provided students and parents the opportunity to receive training on basic computer skills. The training was based on the NTeQ model (Morrison, Lowther, & DeMuelle, 1999) which provides teachers a framework to develop problem-based lessons that utilize real-world resources, student collaboration, and the use of computer tools to reach solutions. The lessons are typically structured around projects, which engage the students in critically examining community and global issues, while strengthening student research and writing skills.

June 26, 2001; 10:30-11:30 am; Room: S504a
Discussant: Valerie Becker

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E-Pals: Examining a Cross-Cultural Writing/Literature Project

Lauren G. McClanahan

Key Words: Technology, collaborative learning, peer-editing, reader response, authentic audience

As a middle school teacher in rural North Carolina, I was intrigued by how writing to an authentic audience helped to raise both the motivation and skill levels of my students, many of whom were reluctant writers at best. A local high school literature teacher had been involved with e-mail projects with students from Japan, Australia, and Russia for nearly ten years. I conducted a case study of his classroom during an e-mail exchange with a high school literature class in Moscow, Russia. During this project, the students in both classrooms read short stories by Anton Chekhov and O'Henry. By using the stories as a catalyst, the students' goal was to help their distant partner to understand the culture from where the literature came. I examined the effect that writing for an authentic audience had on the local students, an audience who was learning to speak English, and paying close attention to how the local students used "real" English. I examined the role that large and small group discussions about the literature played on the final written products. Finally, I examined the role that peer editing played. When examined holistically, it became evident that no single element could be given credit for improving the writing skills of the local students.

June 25, 2001; 3:30-4:30 pm; Room: S504a
Discussant: Raymond Rose

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Web-Based Computer Supported Cooperative Work

John E. McEneaney, Ph.D.; Co-authors: Wendy M. Subrin, Homa Roshanaei, Bryan Baroni, and Ledong Li

Key words: online interaction, cooperative work, Web, PT3, CSCW, CMC

Computer-supported cooperative work (CSCW) has been a focus of research and development since the middle 1980s (Greif, 1988; Grudin, 1991), and business and industry have wasted no time in adopting CSCW techniques and technologies (Rein, McCue, & Slein, 1997). Educators, however, have shown less enthusiasm. Implementing it usually involves considerable expense and technical expertise. There are, however, inexpensive and widely available Web-based tools that can be assembled into workable, if not completely integrated, systems that can achieve many of the objectives of complex and expensive CSCW systems. We began by identifying a loosely organized toolset of familiar office applications and, over a period of approximately 18 months, developed an interactive Web site to support project activities as the needs and interests of projects participants became apparent. Specific office applications were employed to establish standard formats for project materials and our Web-based system gradually evolved into our primary channel for both gathering and disseminating project information, support materials, and project-related documentation.

June 25, 2001; 2-3 pm; Room: S504a
Discussant: Ricky Carter

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Adapting Online Education to Different Learning Styles

Diana J. Muir, Ph.D.

Key Words: online education, homeschoolers versus traditional, standardized testing

The purpose of this research project was to determine if online learning could be adapted to individual learning styles and if that made a difference in the standardized testing scores of Internet students. We then compared those scores to those of traditional students. It has clearly been shown that online learning is adaptive, whereas traditional classrooms are not always adaptable. Our goal was to establish whether online learning and adaptive learning styles made a difference in test scores, and if so, could that knowledge be utilized in the traditional classroom? The answer was yes to both questions.

June 27, 2001; 10:30-11:30 am; Room: S504a
Discussant: Jody Underwood

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Enhancing Elementary Students' Creative Problem Solving through Project-based Education

Romina M. J. Proctor

Key words: Creativity, Integration, Collaborative Learning, Project-based

Curricula, Elementary.

This paper reports on one dimension of a longitudinal study that researched the impact on student creativity of a unique intervention program for elementary students. The intervention was based on the National Profile and Statement (Curriculum Corporation, 1994a, 1994b) for the curriculum area of Technology. The intervention program comprised project-based, collaborative, and thematically-integrated curriculum units of work that incorporated all eight Australian Key Learning Areas (KLAs). A pre-test/post-test control group design investigation (Campbell & Stanley, 1963) was undertaken with 520 students from seven schools and 24 class groups that were randomly divided into three treatment groups. One group (10 classes) formed the control group. Another seven classes received the year-long intervention program, while the remaining seven classes received the intervention, but with the added seamless integration of information and communication technologies (ICTs). The effect of the intervention on the personal dimension of student creativity was assessed using the Creativity Checklist, an instrument that was developed during the study. The results suggest that the purposeful integration of computer technology with the intervention program positively affects the personal creativity characteristics of students.

June 26, 2001; 1:30-2:30 pm; Room: S504a
Discussant: Jeremy Roshelle

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Effective Teaching Styles and Instructional Design for Online Learning Environments

Ian J. Quitadamo; Abbie Brown, Ph.D.

Key Words: teaching styles, distance education, education technology, critical thinking

Internet-based, distance learning solutions are finding increased use, and may prove effective in facilitating advanced study coursework for remotely located, place-bound students. Despite the current emphasis on distance learning, the conditions for promoting online learning success have not been entirely defined. We present a case study that profiles the teaching challenges and benefits of an online graduate-level Instructional Design course for in-service teachers taught through Western Governors University and Washington State University. This work addresses some of the teaching challenges for this online instructional experience, focusing specifically on how teaching styles were used to build online learning community, to effectively promote productive and satisfying learning interactions, and develop student problem-solving and critical thinking abilities. Also discussed are those instructional design strategies that were repeatedly employed in multiple course sections to increase online student engagement, critical thinking, and enhance student learning. The findings of this study should prove of interest to anyone currently developing or delivering online instruction.

June 27, 2001; 10:30-11:30 am; Room: S504a
Discussant: Jody Underwood

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Teaching and Learning With Information and Communication Technology: Success Through a Whole School Approach

Grant Ramsay

Key Words: Teaching and learning with ICT, Whole school implementation, Student learning outcomes, A model for real success

This paper reports on research carried out through a case study which sought to identify how institutionalized teaching and learning practices and processes‹'the way we do things around here'‹led to successful teaching and learning with information and communication technology (ICT) at a large contributing New Zealand primary school (700 students aged 5 to 11 years). The research findings were considered against the backdrop of the international literature, historical trends, and current educational conditions for New Zealand schools in relation to ICT. A major contention of this research is that government funding for ICT in schools should be linked to demonstrable improvements in student learning outcomes. The research also contends that immediate adoption of 'practised and proven' approaches already existent in some schools would help many other schools improve teaching and learning with ICT in their respective learning communities.

June 27, 2001; 1:30-2:30 pm; Room: S504a
One paper only.
Discussant: Romina Proctor

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Cross-Country Conversations: Techniques for Facilitating Web-based Collaboration

Julie Reinhart, Ph.D., Joe Slowinski, ABD, M.Ed., B.A., Tiffany Anderson

Key Words: Web-based collaboration, preservice education, teacher-training, group-development, virtual collaboration

Imagine you are a member of the 21st Century Teachers Network. As an active participant, you will strive to: build your own expertise in using new learning technologies; share your expertise and experience with colleagues; use your expertise with students as part of the daily learning process; work to make classroom technology available to all students and teachers. This is what we asked our students to do. This paper describes an online collaborative process between three university classes in a cross-country project. Recommendations are also provided to offer guidance on how to improve online collaboration. June 25, 2001; 3:30-4:30 pm; Room: S504a
Discussant: Raymond Rose

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Fostering Girls' Computer Literacy through Laptop

Learning: Can Mobile Computers Help to Level Out the Gender Difference?

Heike Schaumburg

One of the goals of introducing computers to the classroom is to support students who are more reluctant to the use of technology or who do not have a computer at home in acquiring computer literacy. Studies have shown that these students are often girls. The goal of the present study is to find out if the difference between boys and girls in computer literacy can be leveled out in a laptop program where each student has his/her own mobile computer to work with at home and at school. 113 students from laptop and non-laptop classes were tested for their computer knowledge and computer confidence. Students from laptop classes outperformed students from non-laptop classes in computer knowledge while there was no difference in computer confidence. In comparison to the non-laptop classes, the gender gap in computer knowledge was much smaller in the laptop classes. In computer confidence, no harmonizing effect of the laptops was found.

June 26, 2001; 4:30 - 5:30 pm; Room: S504a
Discussant: Carolyn Knox

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Commonalities in Educational Technology Policy Initiatives Among Nations

James Schnitz

While education systems from nation to

nation differ significantly according to national character and local requirements, developments in public policy initiatives regarding the use of technology in schools have followed similar patterns among nations as diverse as the United States, Great Britain, Denmark, Italy, Viet Nam, Germany, France, Singapore, Japan, Mexico and Brazil. It is postulated that the commonalities in such initiatives stem from the emergence of a global digital economy and society, and that education reform has taken on an unprecedented global character, regardless of initial status of an educational system, as a consequence. It is further postulated that the commonalities are the product of a reactive approach to educational reform, that rational decision-making has been inadequately applied to public policy and instructional decision-making, and that the issues not yet addressed promise to pose significant impediments to getting an adequate return on the broad investments in ICT among the various nations.

Wednesday, June 27, 2001; 3:00 pm - 4:00 pm; Room: S504a
Discussant:

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Building Awareness of Text Structure through Technology

Edith A. Slaton, Ph.D.

Historically, research has shown that a reader's recall of ideas from text is enhanced when the reader uses relations among concepts to organize information (Meyer, 1975,1979). Text structure is a term used to describe the various patterns of how concepts within text are related. Knowledge of text structures assist a reader to comprehend text by allowing the reader to anticipate information and by helping the reader infer information that may have been omitted by the author (Leu, D.J. & Kinzer, C.H., 1995). Burns, Roe & Ross (1999) state that it is important to attend to teaching text structure because knowledge of patterns of text organization has been shown to facilitate comprehension. Text structure may be considered a blueprint to help a reader build meaning from text. As research has indicated, teaching students to utilize organizational patterns in text facilitates their comprehension of text. Computer programs are available to assist in creating visual representations of text by providing a framework for teachers and students to arrange concepts and show how ideas are related.

June 26, 2001; 12 noon-1 pm; Room: S504a
Discussant: Ana Bishop

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Assessing New IT Workers: Adult Women and Underrepresented Minorities

Karen Spahn

According to the Bureau of Labor Statistics (1997), the need for computer scientists, computer engineers, and system analysts will double from 1996 to 2006. Underrepresented minorities (i.e., American Indians, Blacks, and Hispanics) constitute about one-fourth of the total U.S. workforce, 30% of the college-age population, and one-third of the birth rate, yet comprise only 6.7% of the U.S. computer and information science labor force. The problem will only get worse unless more women and members of the minority groups enter the field (Foster, 2000).

Since data is not available on the number of adult students enrolled in IS/IT programs (i.e., computer information systems, information technology, and technology management), only a few studies have examined their participation in baccalaureate and/or master's level IS/IT programs. To date, most of the research has centered on K- through traditional-age college students. The results of an NSF-funded research study (Spring 2001 completion) on adult women and minority students returning to a non-traditional four-year university designed for working adults over a five-year period (1995-2000) will be presented.

Tuesday, June 26, 2001; 12:00 pm - 1:00 pm;
Room: S504a
Discussant: Ana Bishop

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Constructionism as a High-Tech Intervention Strategy for At-Risk Learners

Gary S. Stager

Key Words: robotics, at-risk, education reform, alternative-learning environments, constructionism, programming

While much has been written about the theoretical basis for constructionism attempted in more traditional school settings, the Constructionist Learning Laboratory at the Maine Youth Center offers the first opportunity to document a full-scale implementation of constructionism in an computationally rich alternative-learning environment built and directed by Seymour Papert. This paper shares examples of work done by severely at-risk students and offers a context for thinking about alternative-learning environments in the digital age.

June 25, 2001; 12:30-1:30 pm; Room: S504a
Discussant: Diana Joseph

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The Evolving Role of School-based Technology Coordinators in Elementary Programs

Neal Strudler, Christy Falba, Doug Hearrington

Key Words: technology coordinator, on-site support, staff development, technology integration While much has been written about the potential of computers to enhance teaching and learning, a wide range of research studies and reports suggest that K-12 schools are not fully realizing the potential of new information technologies. One recent report suggests that while technology implementation in education is improving, only 24% of schools are using computers effectively (CEO Forum, 1999). Commonly cited reasons include inadequate computer resources, lack of teacher preparation, lack of planning time, and lack of on-site support. Several studies have documented ways in which effective technology coordinators have helped schools to overcome these impediments to computer implementation. Despite clear evidence supporting the need for such positions, however, most school districts have been hard pressed to allocate funds on a large-scale to support released-time technology coordinators. In 1997, the Clark County School District (CCSD) in Las Vegas, Nevada, approved a plan to provide released-time coordinators to facilitate technology integration in all of its K-12 schools. This paper documents the implementation of that plan in CCSD's elementary school programs.

June 26, 2001; 10:30-11:30 am; Room: S504a
Discussant: Valerie Becker

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Building Positive Attitudes among Geographically-diverse Students: The Project I-57 Experience

Paul A. Sundberg

Key Words: Computer-Mediated Communication (CMC); Contact Hypothesis; multiculturalism; regional diversity; social, ethical and human issues

This paper is a study of computer-mediated intergroup contact within Project I-57, a larger educational technology project funded by a one-year ISBE grant (Technology Literacy Challenge Fund) and conducted during the 1998-99 school year. Participating institutions were five middle and high schools in three distinctive

geographic/cultural regions along north-south Illinois highway I-57: the Chicago area, the central farm belt, and Southern Illinois. The students varied not only geographically, but also socially by community size, ethnic make-up and age. The Department of Educational Psychology at the University of Illinois (Urbana-Champaign) served as one partner institution. The project's goals were to foster multiple skills (reading, math, etc.) via authentic student research on their communities and to "make [their] students' worlds bigger" through sharing about themselves and their (cultural) communities with classes in other regions to create an appreciation of the state's diversity. The goals of this present study were to evaluate expected changes in students' "understanding" of the other two regions and populations in the twofold sense of knowledge of and attitudes towards the "outgroup"‹more positive ones, it was hoped‹due to the virtual contact and greater knowledge facilitated by the project.

June 25, 2001; 12:30-1:30 pm; Room: S504a
Discussant: Diana Joseph

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A Model for Pedagogical and Curricula Transformation with Technology

David R. Wetzel, Ph.D.

Key Words: staff development, contextual barriers, instructional technology, pedagogy

The purpose of this study was to investigate the factors that influenced five middle teachers as they implemented and integrated instructional technology in their curricula. Along with determining the effects implementation and integration of instructional technology had on their pedagogy and curricula. The study involved empirical research with both qualitative and quantitative data. Data analysis included a cross-case analysis of multiple case studies. Data were gathered August 1999 through December 1999. This time period was selected because it provided the opportunity to test the ST3AIRS Model in a school setting from the beginning process of implementation and integration of a new technology.

June 26, 2001; 3-4 pm; Room: S504a
Discussant: Craig Cunningham

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A Picture of Change in Technology-rich K-8 Classrooms

Keith Wetzel, Ron Zambo, Ray Buss, Helen Padgett

This qualitative study reports on Arizona Classrooms of Tomorrow Today (AZCOTT), a component of a Preparing Tomorrow's Teachers to Use Technology project. In conjunction with five partner school districts, Arizona State University West developed five technology-rich K-8 classrooms to serve as models for preservice students and university instructors. This study report describes changes occurring as the AZCOTT teachers learn to teach in technology-rich classrooms. Changes are described in teacher practices and student attitudes. Factors supporting change are discussed. Finally, the researchers discuss the progress made toward using these classrooms as models for preservice students.

June 25, 2001; 11 am-12 noon; Room: S504a
Discussant: Kyle Peck

UCI Computer Arts:
Building Gender Equity While Meeting ISTE NETS

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Key Words: elementary, gender, constructivism, multimedia learning activities

Abstract

Multimedia computer learning activities, when designed according to what we know about children's preferences, may help close the so called" gender gap" in attitudes about computer usage in schools. This paper includes a brief overview of gender-gap research, a description of one response: the UCI Computer Arts program (aligned with ISTE NETS: National Educational Technology Standards for Students), and the author's dissertation research: 410 coded observations of 76 4th and 5th grade students over six weeks while they worked in same and mixed sex pairs on multimedia learning activities. The study revealed that females were as active, if not more so than males, when they were involved in constructivist, cooperative, curriculum based, multimedia learning activities, and both groups were more active in same-sex pairings.

The Gender-gap Problem

The persistence of a gender gap in computer usage in education has been well documented: females continue to be under-represented in computer science programs in high schools and colleges, and later in computer related careers (AAUW, 1992 & 1998). Females are reported to use computers less often, with less enthusiasm, and differently than males (Bunderson & Christensen, 1995; Christie, 1997; Kirkpatrick & Cuban, 1998; Mitra, 1998; Sanders, Koch, & Urso 1997). This gap first appears in the elementary grades and widens as students move through middle and high school, into college and beyond (D'Amico, Baron & Sissons, 1995; Durndell, Glissov & Siann, 1995; Nathan & Baron, 1995). While in the early grades (i.e, 1-5), females and males demonstrate similar attitudes about, and abilities in, computer usage (Armitage, 1993). However as females advance through the middle, secondary, and postsecondary grades, they are under-represented in computer science courses while they are over-represented in computer applications courses such as word processing and data management courses (Becker, & Sterling, 1987; Bunderson & Christensen, 1995). These trends have raised the specter of unequal participation by females in the economic and cultural life of the information age (AAUW, 1998).

In a recent article, Heather Kirkpatrick and Larry Cuban asked, "should we be worried?" about this gender gap, given the importance of computers in the 21st Century: "The research strongly suggests that if females do not gain experience with computers, they will not be as positive about computers or be as proficient on computers as their male peers (Kirkpatrick & Cuban in Jossey-Bass, 2000, p 160)." Students' attitudes about computers are shaped by the amount, as well as quality, of previous computer experience, "Hence a self-perpetuating cycle exists..." (Kirkpatrick & Cuban, 1998, p. 58). More positive experiences with computers generate better attitudes and so forth (Mitra, 1998; Sacks, Bellisimo & Mergendollar, 1993-94; Shashaani, 1994). Males acquire more experience with technology than females, inside and outside of the classroom, and they tend to have better attitudes about computer usage overall (Kirkpatrick & Cuban, 1998; Proost, et al.,

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1997). Therefore, we need more positive educational computer learning experiences for females as well. The following section deals with some of the causes of the gender gap in computer usage, their influences on student attitudes, and efforts to address this problem in schools.

Responses to the Problem:

In a report to the President of the United States, the President's Committee of Advisors on Science and Technology alluded to the paucity of research in this area: "A modest amount of research has attempted to identify factors that might account for gender-specific differences in the appeal and effectiveness of certain types of programs and of various environments and contexts for computer use..."(1997, p. 79). For example, researchers have examined gender preferences for various types of educational programs, computer-assisted instruction (CAI) software (tutorials, drill and practice, games and simulations), and various types of learning activities and settings (Braun & Giroux, 1998; Durndell, Glissov & Siann, 1995; Fiore, 1999; Hood & Togo, 1993-94; Huff & Cooper, 1987; Jakobsdóttir, Krey & Sales, 1994; Nathan & Baron, 1995). This research has tended to reveal what has been called females' "deficiencies" in competitive educational games and mixed sex computing environments (AAUW, 1998). Therefore recommendations have tended to be compensatory, such as designing software and Web sites to appeal to girls. This approach has been problematic. For example, Fiori tested female students' reactions to instructional game-like programs with features that had been assumed to appeal to female users. Instead, she found that the females consistently preferred "paint", not game programs (1998). This illustrated the difficulty with making assumptions about female preferences for software features and types.

Other research in computer lab settings have revealed that females may be intimidated by the presence of males when using game format, competitive software thus putting them at educational disadvantage (Cooper, Hall & Huff, 1990). A response to this has been to recommend single sex computing environments (Fiore, 1998; Sanders, 1998). The critique of this approach is that it may further distance females and males in both expectations and understanding. Thorne has been critical of the segregation of females and males in elementary schools, in classrooms and on playgrounds. She calls for more "border work", female and male children learning to work with each other through mixed sex cooperative activities (Thorne, 1998).

A promising area of research has been the analyses of socially-constructed sex role expectations and stereotyping behaviors that occur in schools and influence female attitudes about computer use. Female attitudes are influenced by family, schools, and society (Brown & Gilligan, 1992). These influences also affect their attitudes about computers (Papert, 1993). By the time that girls enter the middle grades (i.e. 5-9), many of them have "read their environments" and have identified computer usage with boys:

> Girls live in the same world that you and I live in. They look around and see Daddy at the computer at home, boys in the computer room at school, boys in the video arcade, and men in the computer ads. They notice that computer hackers are almost invariably male. They see boys responding in droves to the thrill of computerized weaponry and war. When girls reach puberty, these observations begin to matter. At the middle-school age, they're sorting out what it means to be a woman in this society: what is appropriate behavior? What are appropriate interests? It is hardly surprising, given what girls see in the world around them that they conclude computers are not quite the proper thing for a real girl to do (Sanders, 1998, p. 163).

These attitudes carry over into the schools. While there may be no explicit signs that girls are not welcome in school computing, they get that message all the same.

All to often classroom teachers are unaware that they may be inadvertently contributing to sex-role stereotyping in the use of computers, an aspect of the "hidden curriculum" of schooling (Apple, 1997). This is a curriculum that instructs females by various "signs "that the use of computers is a male pastime: computer labs dominated by males, game-like instructional software that appeals to males, and computing responsibilities assigned to males. Teachers can ameliorate this by employing a variety of strategies including: establishing and maintaining "safe" computer use settings (Cooper, Hall & Huff, 1990; Saunders, 1988), the use of productivity rather than game-like software (Fiore, 1999; Kafai, 1995) and assigning curriculum-based multimedia presentations (Burge, 1999), the use of cooperative groupings (Slavin, 1995), and other gender equity strategies, such as acknowledging the contributions of females and males equally (Horgan, 1995).

The following section describes a program designed to appeal to females and males alike.

UCI Computer Arts Program: 1997- 2001

This program was in alignment with all six areas of the Technology Foundation Standards for All Students (ISTE, 2000, pp 14-15), and involved university undergraduate students in the UC Irvine undergraduate Minor in Educational Studies, who tutored pairs of upper-grade (4-6) elementary students in the development of multimedia (PowerPoint and Internet) projects in academic content areas (such as language arts, social science, and science), over six weeks. The design of the program was informed by gender research in computer usage. The objectives included developing computer, online and traditional research and presentation skills, and awareness about university life. The elementary students prepared curriculum-based PowerPoint classroom presentations, and in the process operated computers and peripherals, conducted research on the World Wide Web, combined electronic resources with classroom texts, cited sources and sought Web master permissions (where appropriate), used color and design elements in the development of informative presentations, and made oral presentations to peers in their classrooms. The UCI Computer arts program employed constructivist methods including cooperative learning and encouraged both individual expression and between-student interaction (Adams & Hamm, 1990, Perkins, 1995). Research in cooperative learning has suggested that females tend to prefer cooperative to competitive learning environments (Sanders, Koch and Urso, 1997). These and other gender effects of computer learning behaviors were the foci of the author's dissertation research.

The Study

The author designed a research study that looked at the gender related behaviors of 4th and 5th grade students while they engaged in UCI Computer Arts multimedia learning activities over six weeks in 1998-1999. Seventy-six students (36 females and 40 males) met for about one hour each week in a school computer lab, in same or mixed sex pairs, with university student tutors while they planned, designed and created PowerPoint presentations about curriculum-based social studies topics. The study employed a non-experimental observational research design that employed quantitative methods in the collection and analyses of 410 coded observations, and qualitative data (i.e., observer comments, journal entries, and online discussion forum transcripts), that were used to explain the quantitative findings. Trained observers recorded frequencies data for 24 behavior measures organized in six behavior categories: Verbal-Linguistic, Visual-Spatial, Logical-Mathematical, Bodily-Kinesthetic, Interpersonal and Intrapersonal (Gardner, 1983, 1993). The primary hypotheses were that (1) there would be significant gender related differences in students' behaviors in multimedia computer learning activities, but that (2) there would not be significant overall differences favoring one gender in this type of complex learning activity.

Unexpectedly, females were found to be significantly more active than males in several measures (Burge, 1999).

Findings

One-way ANOVAs revealed significant or nearly significant differences for behaviors favoring females: Listens (p=.056,.042), Reads (p=.008,.006), Writes (p=.025,.002), Uses color, line, texture (p=.021), Controls mouse or keyboard (p=.010,.004), Points gestures (p=.053,.010), Assertive (p=.026, .015), and Motivated(p=.067), and (2) favoring males: Chooses graphics (p=.081), and Moves graphics (p=.027,.061). Two-way ANOVAs revealed effects of gender pairing in the following categories: Listens (p=.055), Reads (p=.032), Motivated (p=.009), and Unmotivated (p=.045). This suggesting that when the partner was the same sex, frequencies of some behaviors increased, and the first three of these four favored female gender pairs.

The following table provides summaries of the one-way ANOVA findings that are significant or nearly significant at or near the <.05 level:

Table 4.9: Summary of the Significant or Nearly Significant Relationships Between Gender and Behaviors

Behaviors	Wks	n: F/M	Gender	Mean	SD	F Ratio	df	p-Value
Verbal-Linguistic								
AQ6 Listens	1-6	204/206	F	2.55	1.150	3.685	408	.056*
			M	2.23	1.056			
	1-3	102/100	F	2.833	1.211	4.20	200	.042*
			M	2.50	1.096			
AQ8 Reads	1-6	204/206	F	1.779	.840	7.205	407	.008*
			M	1.56	.769			
	4-6	102/106	F	1.971	.928	7.782	205	.006*
			M	1.629	.835			
AQ9 Writes	1-6	204/206	F	1.936	1.060	5.054	408	.025*
			M	1.714	.942			
	1-3	102/100	F	2.01	1.029	10.04	200	.002*
			M	1.59	.842			
Visual-Spatial								
BQ10 Uses color line, texture	4-6	102/106	F	1.725	.810	5.431	206	.021*
			M	1.491	.636			
BQ11 Chooses graphics	1-3	102/100	F	1.755	.849	3.069	200	.081*
			M	1.990	1.049			
BQ12 Moves graphics	1-6	204/206	F	1.505	.726	4.949	408	.027*
			M	1.694	.977			
	1-3	102/100	F	1.637	.842	3.547	200	.061*
			M	1.9	1.124			
Bodily-Kinesthetic								
EQ20 Controls mouse or keyboard	1-6	204/206	F	2.907	1.181	6.613	408	.010*
			M	2.597	1.256			
	4-6	102/106	F	2.990	1.104	8.669	206	.004*
			M	2.509	1.244			
EQ21 Points, gestures	1-6	204/206	F	2.549	1.380	3.772	408	.053*
			M	2.286	1.358			
	1-3	102/100	F	3.020	1.414	6.697	200	.010*
			M	2.490	1.494			
Interpersonal								
FQ25 Assertive	1-6	204/206	F	1.745	.867	4.984	408	.026*
			M	1.568	.734			
	4-6	102/106	F	1.833	.797	6.031	206	.015*
			M	1.585	.660			
Intrapersonal								
GQ29 Motivated	1-6	204/206	F	1.955	.771	3.382	408	.067*
			M	1.815	.775			

* Indicates a p-Value that is significant at or near the.05 level or below.

Source: Burge, 1999.

Implications

While the size and scope of this study was limited, the initial results were promising for the development of computer learning experiences that appealed equally to females and males. The one-way ANOVA results suggested that multimedia computer learning activities may encourage female participation in computer usage with the same or even greater frequency as with males. The two-way ANOVA results (table not included) suggested that the same sex pairs were more active than the mixed sex pairs. The implications of the findings in this study for instructional planning were that when thoughtfully implemented, multimedia computer learning activities can engage females equitably, if differently, with males in computer usage.

In subsequent tutoring sessions (2000-2001) the university tutors made informal observations consistent with the 1999 study, that females usually shared the tasks of developing the PowerPoint projects, and focused on the verbal-linguistic elements of their presentations. Male students tended to lose interest when not in control of the mouse, and were attracted to the colors, graphics and animation features. However there appeared to be no gender gap in student motivation. The overwhelming majority of students, females and males alike, in same or mixed sex pairings, demonstrated high levels of persistence and pride in the multimedia presentations which are often exhibited in classrooms for their peers. Multimedia learning activities clearly had the potential to engage and challenge students to do their best work. It remains to be seen whether longitudinal research will reveal lasting effects on closing the gender gap in student usage of computes in the upper grades and beyond.

Conclusion

While there has been considerable attention to the problem in recent years, females continue to be underrepresented in the use of computers both inside and outside of educational settings (AAUW, 1992, 1998). Research has revealed features of computer-based educational settings that appeal to females: the use of productivity software, cooperative settings and constructivist methods. This paper described how the author used these findings to select the features of the UCI Computer Arts program: academic content analyses and organization, online and traditional research methods, intellectual property considerations and electronic citations, multimedia planning, design and presentation, and cooperative learning skills. The author conducted a year-long study that found that, when computer learning activities were designed to appeal to females and makes alike, that the females were as active, if not more active, than the males in computer usage. The findings from this and other research suggests that by "paying attention" to the needs and expressed interests of females, teachers can design learning environments that will encourage females and males alike in using computers.

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From Mythology to Technology: Sisyphus Makes the Leap to Learn

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Key Words: Professional Development, Web Instruction, Technology Training, Instructional Technology, Constructivist

Abstract

Making the leap to a technology-enhanced, online educational experience has been a four-year labor of love as well as a steep learning curve for the *NatureShift! Linking Learning to Life* project. A five-year U.S. Department of Education Technology Innovation Challenge Grant (TICG), the *NatureShift (NS)* project was awarded in 1997 to the partnership of Dakota Science Center and the Grand Forks Public Schools. It was designed with partners from the Sahnish Cultural Society and the University of North Dakota to take technology and hands-on learning to an information-isolated highway of communities including public schools, tribal schools, parks, museums and libraries. It soon became a true test of mettle for learners, educators, community volunteers, and instructional designers alike. This paper will discuss lessons learned from the project's first three years of training educators in the application of the *NatureShift* Exploration Model, a teaching and learning strategy that borrows heavily from informal education, formal education and instructional technology. The model establishes a standard for teaching and learning with technology derived from constructivist, inquiry-based educational theory and practice. As a professional development and learning tool, the model proved as difficult to teach as the new technologies it used. It soon proved its value, however, once trainers stopped teaching it and began using it to teach. Likewise, the findings of the project have shown that teaching new technology works more effectively when educators are not taught the technology but rather are given opportunities to use it to do what they do best—teach.

Pedagogy

The computer and the Internet have radically changed the face of traditional educational technologies and with their introduction into education these new tools have also affected what we understand about teaching and learning. The computer crept slowly into education in the mid-twentieth century, at first for machine-like conversations with humans that mimicked the lock-step robots of the assembly line, computers were for "programmed instruction"[1] (Goldsworthy 2000, Skinner 1958). Eventually, however, computing peppered the landscape of learning and tossed in its own instructional rules into the process that suggested technology could aide learners in constructing meaning from the learning process (Harper *et al.*, 2000). The recognition of ways technology gives learners control over much of the learning environment challenged the educator's traditional role. The ability of the learner to interact with the content, to reorder it, reshape it, or question it, at his or her discretion meant that educators had to revise their most core concepts of teaching, relearning how to shape an instructional experience in this new environment (NCES, 1999). This landscape required multidimensional as well as multimedia construction (Havinga 2000). Not only was a teacher faced with the challenge of framing a lesson plan according to new principles, they had to design instruction that could be delivered through this foreign medium of technology and learn new rules of engagement—to understand how students interacted with technology for learning (Elkind 2000).

The use of the new technologies in framing instruction, first the computer and later the Internet, gave the learner freedom to create personal learning goals and eventually build new learning constructs. However, these glamorous new tools quickly developed their own mythology. The computer, the digital camera, the informational technologies of the Internet solicited more interest than the work they were created to do. Learning got lost in the glamour. These new technologies also came with learning curves. Educators either embraced them as exciting challenges or evaded them as impediments to the instructional process. *NatureShift* was designed to employ and infuse new technologies into its model and its methods. Its mandate to bring technology and its training to educators from the vastly different worlds of formal classroom education and informal free-choice educational settings was a monumental goal. *NatureShift* was faced with a double-edge challenge: to train educators in the use of new technologies and, at the same time, in a new model for teaching and learning with technology. What the project discovered early was that professional development for educators required debunking the technology myths that impeded learning new methods and practices.

Importance of the Study

New national technology standards for students and teachers coming out of ISTE[2] as well as other organizations are being accepted nationally by accreditation organizations such as NCATE[3]. These have raised the bar for pre-service teacher education and are rapidly pressuring for adoption of higher technology standards by public schools nationwide. The educational community is being asked to increase technology access and implement rigorous technology profiles throughout its schools and universities even as it struggles with implementing best approaches to training its educators. Add to the picture a technological landscape that keeps growing and changing and the importance of successful training methods becomes paramount. The *NatureShift* experience has shown that the challenge for training in-service as well as pre-service teachers and informal educators is indeed great and there is not an easy answer. Nevertheless, we have seen trends that suggest there are rules that work in this new landscape. One finding of particular note has been the discovery that differences in training needs and technology skills could be surmounted by concentrating training on using technology to accomplish tasks that are known. By modeling technology use, empowering teacher-learners to put hands on the technology, and integrating the technology with meaningful tasks clearly worked during training.

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[1] Programmed Instruction, a term referring to drill and response instructional exercises programmed into early computers with feedback stamped out on punch cards. Learners performed drills until they mastered the content. The practice was introduced to education during the 1950s when B.F. Skinner's *stimulus and response* educational theory was at its height.

[2] International Society for Technology in Education

[3] National Council for Accreditation of Teacher Education

The *NatureShift* Challenge

The *NatureShift* project has 10 pilot site partners who implement the *NatureShift* "Exploration Model" using curricular content from five cross-disciplinary education modules. Five pilot sites are formal school environments, and five are informal (or free-choice) educational environments (parks, libraries, and museums). The project provides professional development in the model and the technologies to educators at all sites. At the start of the project, *NS* educators approached professional development using known methods of training. Those methods included trainer-to-trainee instruction and hands-on activities to learn the technologies (computer hardware, educational software, scanners, QTVR production, and video camera). Teachers were given specific tasks to learn the technologies and then specific tasks to learn the ingredients of the model, all new content for teachers to learn but doing so using instructional practices that were very familiar. This approach quickly introduced educators to new technology. Teachers learned to use the video camera and they were thrilled. Sometimes they learned effective strategies to integrate the camera into their instruction. The same for learning the computer and other new technologies. Practice in creating technology-enhanced instruction that followed the precepts of the *NS* model met with the same results. Teachers learned to set-up a lesson by Engaging students with an authentic situation or task. They built Web Adventures so their students could learn how to research using the Internet. They loved learning to construct Real World Adventures that put meaning into students' understandings. They learned to design multimedia projects or portfolios that taught their students to construct meaning from their learning. Yet, after every *NS* site training or conference workshop, participants failed to retain most of the knowledge they had gained. Worse yet, trainees had more problems when they returned to their sites. Either the technology failed or they could not remember how it worked, and they had no time to redesign curriculum or even a lesson plan that incorporated new technology. If they did not get enough training at the workshop, the technology did not get used.

By the start of the grant's third year, the project was faced with a dilemma. Staff was modeling new technologies. They were modeling innovative teaching and learning strategies. Yet, knowledge was not being retained. Teachers did not remember the technology at follow-up workshops, nor were they demonstrating any ability to transfer knowledge gained to new situations. At partner workshop after workshop, the same questions and issues arose. "Technology is too hard to learn.... It always breaks down.... I don't have time in my day to do all this creative planning... I can't teach students to use a technology I don't understand... I don't know what I'm supposed to do with this technology."[4]

Lessons Learned

In year three of the grant, the project changed course. *NatureShift* sponsors several workshops throughout the year, including two professional development workshops for partners. Each workshop and training includes surveys and self-assessments for participants to evaluate their learning. Although a formal statistical analysis of data will not be completed for another year, an anecdotal review of participant comments, taken in fall, 1999 revealed a common response. Participants were asking for *application* training. They wanted to know *how* to apply the *NatureShift* model, not how to use technology to implement the model. In response, the project tested a new training approach during its January 2000 workshop.

Partners were given the task to create the Web pages that would represent their work on the *NatureShift* Web site. Only 10 percent of partners knew anything about creating Web pages. They had not retained lessons in how to capture images and most had not learned to use photo manipulation software. They were not promised any training in technology but a voluntary technology lab was put at their disposal for practicing any of the technologies they wished to learn. Ninety percent of workshop participants availed themselves of the technology lab. Evaluation comments at the close of the workshop revealed nearly 95% satisfaction with the workshop. Several evaluation comments clearly indicated educators felt they learned a great deal of technology as well as a new appreciation for Web-based instruction. Yet, no targeted technology training had been used during the workshop! Participant knowledge of technology was addressed on an individual basis during production.

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[4] Compiled data from *NS* Summer Institute and Winter Workshop "Exit Questionnaires," 1998-2000.

The positive results of the Winter Workshop provided insight in designing the weeklong Summer Institute of July, 2000. Although not yet tabulated, cursory results from the Institute clearly indicate that using project-based instruction is much better at overcoming the technology learning curve than drilling in skills or putting technology in an educator's face and hoping they will overcome their preconceptions about it. At the Institute, partners were asked to design a *NatureShift* Exploration that would meet a curriculum need in their classroom. They were told their Exploration would have to be evaluated and would go up on the *NatureShift* Web site. Again, there was no focus on learning technology, although new technology instruction was offered in audio production, video production, Inspiration software, and digital cameras. Teachers had to use cameras to record events at the Institute. They had to use Inspiration to present their curriculum concept, and they had to learn how to work in a networked environment on the computer. They were given plenty of time to work on their tasks. The results were more stunning. When partners returned home, they remembered how to logon to the *NS* server and transfer files. They complained when they did not have the latest technology because they already had plans for its use. Half of the partners had begun and even finished their *NS* project the following fall before staff had inquired into their progress. The basis of the *NatureShift* model is to build critical thinking and engage learners in problem-solving and inquiry-learning. It outlines a method for teaching that, when used for professional development has begun to prove its worth. The true test came when partners were asked to present their *NS* work and the ways they had found the project to be helpful. Presentations ranged from PowerPoint to posterboard. In each case, a clear confidence and appreciation of technology was evident. Projects reflected the clear value and place that technology would hold in their lifelong learning.

Evaluation Methods

The sources of data for this study include evaluations completed by partners, outside workshop participants, and preservice teacher candidates enrolled in the *NatureShift* elementary education technology course at the University of North Dakota. Except for outside workshop participants, teacher candidates and partners all completed post evaluations of each training session. In addition, anecdotal data was collected at every course. Evaluation and survey instruments have not been validated, but were created by the project internal evaluators and have been consistently applied during the life of the project. The project's external evaluators will conduct statistical analysis of the data. Each pilot site educator is currently required to create a complete *NatureShift* Exploration, including all pedagogical stages of the model. During the final year of the project, educators will be required to conduct an evaluated test of their *NatureShift* Exploration in one of their classes or with selected students. The Exploration model requires students to process what they have learned and thought in a summative project. The student projects from an educator's Exploration will be evaluated for evidence of knowledge acquired and critical thinking. Evaluations will consist of a teacher assessment rubric, student assessment rubric and evaluator assessment of project content. The external evaluation team will provide the rubrics. The team will also evaluate student projects for evidence of critical thinking and knowledge acquisition. If partner educators have acquired skills with technology and grasped an understanding of how students learn by using different technologies, their Exploration projects will reveal the clearest evidence of that knowledge.

Summary

The myths of technology create strong impediments to understanding it. What are some of the typical myths that crop up and blur our vision? "Technology is fun! Students will be engaged just because we use it. Technology IS the curriculum. Technology is too difficult to learn. Technology is easy. Creative planning for technology takes a long time. Technology makes teaching better, more productive. Technology always breaks down." (*NatureShift* Project, Annual Reports of Progress). In some instances any one of these myths might be true. Yet it is the resulting attitude that colors our approach to learning. What *NatureShift* discovered is that educators come to a workshop with their myths embedded deeply to remain even after training has taught them differently. The most effective method the project has found to overcome the mountain of resistance or misconception is to remove the mountain from view. Give the learner the task of putting one foot in front of the other and the mountain is easily crossed because attention is diverted to territory that is understood. Give teachers an instructional task and they will learn technology like they learned to write on the blackboard, without little thought of the chalk in their hand.

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Simulations in the Learning Cycle: A Case Study Involving *Exploring the Nardoo*

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Introduction

This study involved students using simulation software in all phases of the learning cycle. Research on the use of simulations in science education has shown that the simulations can be used effectively in preinstructional (Hargrave & Kenton, 2000; Gokhale, 1996) and exploratory activities (de Jong & van Joolingen, 1998). Preinstructional and exploratory activities elicit and challenge students' alternative conceptions. Having set the context for formal instruction, simulations then can be used to learn new concepts in the invention phase of the learning cycle. With the specific guidance in simulations such as *Exploring the Nardoo* (Harper & Hedberg, 1996, 1997), students perform better (Lee, 1999). Simulations can be used again to apply newly learned concepts in different contexts in the expansion phase of the learning cycle.

Background

Simulations in science education

Simulations have aided scientists in extending their experiences to otherwise unobservable phenomena (Richards, Barowy, & Levin, 1992; Snir, Smith, & Grosslight, 1995; Coleman, 1997; Jonassen, 2000). Simulations can perform a similar function for students in restrictive classroom environments by providing science experiences they would otherwise be unable to have (Roberts, Blakeslee, & Barowy, 1996). Simulations also serve to "bridge the gap between complex mathematical theories and experience. . . They create new visual representations of phenomena that aid in building scientific intuitions" (p. 69; see also Jackson, 1997; Lee, 1999).

The use of simulations that represent scientific models can help prepare students for building their own models. According to Gabel (1999), simulations are especially useful for scientific models that "are difficult or impossible to observe, or are so complex that they are difficult to study in the laboratory. . . Use of simulations tends to result in increased achievement on complex and difficult concepts in less time than conventional instruction" (p. 163; see also Eylon, B-S, Ronen, M., & Ganiel, U., 1996; Windschitl & Andre, 1998; Härtel, 2000).

Reports on the effects with simulations on student learning have varied widely (de Jong & van Joolingen, 1998; Windschitl & Andre, 1998; de Jong, Martin, Zamarro, Esquembre, Swaak, & van Joolingen, 1999; Lee, 1999), making generalizations difficult. Some studies show that inadequate teaching strategies inhibit learning with simulations (Roberts et al., 1996; Jackson, 1997; Windschitl & Andre, 1998). Roberts et al. (1996) study, as well as others (de Jong & van

Joolingen, 1998; Lee, 1999), indicate a need for better skill preparation and guidance of learners. Roberts et al. claim that students perform best when "shown the way and then left to learn by doing" (p. 48), which the researchers say is similar to Collins' (1990) cognitive apprenticeship. Students first need to acquire skills in information appraisal, selection, organization, structuring, and communication of ideas (Harper & Hedberg, 1997).

Hargrave and Kenton (2000) suggest that the variety of effects observed with simulations may result from the variety of definitions for simulations, and they provide a comprehensive definition derived from the research literature (see conclusion). De Jong and van Joolingen (1998) provide a more concise definition: "A computer simulation is a program that contains a model of a system (natural or artificial; e.g., equipment) or a process" (p. 180). In a metaanalysis of instructional simulations, Lee (1999) reports that using different instructional modes of simulations (presentation and practice) is one reason for conflicting results. Lee also describes differences in the nature of simulations, which can be either "pure" or "hybrid," with the latter incorporating both presentation and practice modes. Overall, Lee claims that students perform better when hybrid simulations are used and when provided with specific guidance.

Exploring the Nardoo and constructivism

In addition to the above considerations, the simulation software used in this study was developed within a cognitive constructivist frameworks under which "learning involves the construction of meanings by the learner from what is said or demonstrated or experienced" (Harper & Hedberg, 1997, p. 4) and in which "[t]he role of the teacher is one of facilitating the development of understanding by selecting appropriate experiences and then allowing the students to reflect on those experiences." The developers of *Exploring the Nardoo* had these considerations in mind when developing the program. Attending to a new technology in constructivism, the developers focused on learning that is mediated by tools and signs which implies that "the tools (technology) and signs (semiotic tools) we use change the form, structure, and character of activities and thus our knowledge" (Harper & Hedberg, 1997, p. 4).

Cognitive tools help learners to organize, restructure, and represent their knowledge (Harper & Hedberg, 1997). The developers of *Exploring the Nardoo* incorporated a series of cognitive and, they hoped, metacognitive tools in their design process. They relied upon key principles of cognitive tools research as summarized by Jonassen and Reeves (1996) for multimedia design:

- Cognitive tools will have their greatest effectiveness when they are applied to constructivist learning environments.
- Cognitive tools empower learners to design their own representations of knowledge rather than absorbing knowledge representations preconceived by others.
- Ideally, tasks or problems for the application of cognitive tools should be situated in realistic contexts with results that are personally meaningful for learners (p. 698, as reported in Harper & Hedberg, 1997).

While software, especially simulations, developed under constructivist frameworks tend to favor group interactions (Linser & Naidu, 1999), individuals who display the motivation and metacognitive skills of self-regulated learners can gain maximum benefit from the software without peer support (Harper & Hedberg, 1997; Gabel, 1999; Jonassen, 2000). Groups, however, can provide forums for the discussion of ideas and suggestions, problem-solving strategies, immediate feedback, and so on. The developers also considered a problem-based learning approach in which students learn more from being given a problem that they must solve rather than from being given instructions on how to do something. Students are presented with an ill-structured problem prior to formal instruction (Harper & Hedberg, 1997). They then must themselves identify and use the knowledge required to solve the problem.

In *Exploring the Nardoo*, an imaginary river ecosystem provides students with opportunities to explore environmental issues while applying science concepts from the areas of biology, chemistry, physics, as well as other subjects areas, such as geography, social science, language, and media studies. Students can explore interactions among living organisms and the physical environment, which focus on human impact at both a macro and micro level (Jonassen, Peck, & Wilson, 1999). Small groups of students can interact and apply problem solving, measuring, and communication skills to investigate issues and report their findings. Their efforts are facilitated by the program's Water Research Centre where three specialists introduce investigations and make suggestions for accessing media, using data-collection tools, and running simulations. Many of the resources are accessed through a personal digital assistant that has been incorporated into the program, providing a problem-solving situation "that enables students to actively manipulate a complex environment, seek information, and conduct investigations in order to construct their own knowledge about ecological issues" (p. 99). The classroom edition includes many activities (in print), divided by subject areas, that help integrate the CD resources into the science curriculum (Rapose, Cesaro, Poirier, Collins, Toppi, & Plante, 1997).

The program allows students to take readings in the simulated environmental sites and answer their "what if" questions by inputting their data, running the embedded simulators, and observing the changes (Harper & Hedberg, 1997). The students can monitor changes in variables as the simulators run, exploring the relationships among the variables in the model systems. "The ability to directly compare input data with output data in various forms simultaneously is a powerful feature of each of these simulators and helps the user in making connections and associations and forming an understanding of the interrelationships between 'cause and effect'" (p. 13). An embedded simulator that was used in this study (blue-green algae) incorporates a real-time graphing feature that allows students to "see" how relationships among variables change with time (Coleman, 1997).

Harper and Hedberg (1997) claim that *Exploring the Nardoo* and related programs were developed to allow students to participate in communities of practice through immersion in authentic activities (see also Harper, Hedberg, Wright, & Corderoy, 1995; Aikenhead, G. S., n. d.). The program's data collection facilities allow information collection from a range of media sources, and the simulations allow students to ask questions and investigate answers to those questions. The problem-solving aspects challenge students to become "active participants in the learning process" (Harper & Hedberg, 1997, p. 11). The program provides a metaphor to the real world that encourages students "to apply scientific concepts and techniques in new and relevant situations . . . throughout the problem-solving process" (p. 12; see also Linser & Naidu, 1999). The simulations embedded in the program enhance the problem-solving process by allowing students to become involved in a realistically situated process where they can manipulate relevant variables and test their hypotheses without risk or consequence and within a reasonable time frame (Harper & Hedberg, 1997; see also Richards, Barowy, & Levin, 1992; Windschitl & Andre, 1998).

This case study focused on biology applications in the *Nardoo* program, specifically dealing with human impact on water quality in the simulated river ecosystem.

Simulations in the Learning Cycle

This case study researchers' interest in simulations in learning cycle lessons stems from their use of learning cycles for constructivist teaching (e.g., Abraham, 1997). The learning cycle format used for this study consists of three phases: exploration, concept/term introduction or invention, and concept application or expansion (Lawson, 1995; Beisenherz & Dantonio, 1996; Sunal & Sunal, 2000) with slightly different terms being used by the different authors. This paper uses the phase terms and descriptions described by Sunal & Sunal: exploration, invention, and expansion. The exploration phase includes open-ended questions and activities that elicit students' prior knowledge and challenge their alternative conceptions. The invention phase includes construction of new knowledge and is identified with formal instruction. The expansion phase includes applying the new knowledge in different contexts.

Educational research on simulations, as with other topics, tends to focus on formal instruction; however, several researchers have reported effective use of simulations in both pre- and postinstructional situations which correspond to the first and third phases of learning cycles (Gokhale, 1996; Windschitl, 1998; Lee, 1999; Hargrave and Kenton, 2000) Though none of the previous researchers refers specifically to learning cycles, Lawson (1995), a prominent promoter of learning cycles, supports the use of simulations in the application phase of learning cycles "to extend and refine the usefulness of terms previously introduced" (p. 310). The use of simulations after or supplemental to formal instruction appears as an acknowledged strategy by researchers (Lee, 1999). Gokhale (1996), for example, claims that simulations used after formal instruction "offers the student an opportunity to apply the learning material" (p. 37). Windschitl (1998) says that the use of simulations after regular instruction serves as a consolidating experience.

Researchers who support the preinstructional use of simulations do so for similar reasons, including the exploration of concepts (de Jong & van Joolingen, 1998) and setting the context for formal instruction (Gokhale, 1996; Lee, 1999; Hargrave and Kenton, 2000). In addition, Lawson (1995) supports the use of simulations in the exploration phase of learning cycles "when the phenomena of interest cannot be directly experienced given the normal classroom constraints" (p. 310). Lawson also acknowledges the use of simulations in learning cycles to provide motivation, provide an organizing structure, serve as a concrete example, or expose misconceptions and other areas of knowledge deficiency.

According to Gokhale (1996) properly designed simulations used prior to formal instruction "build intuition and alert the student to the overall nature of the process" (p. 37). Hargrave and Kenton (2000) claim that students who experience topics through simulations prior to formal instruction become "active creators of knowledge," assuming greater control of the content and their own learning (p. 54). Windschitl (1998) says simulations can be used to introduce especially challenging or unfamiliar concepts before "didactic" instruction, thus setting the cognitive stage by providing organizational structure. Lee's (1999) hybrid simulations, which include both presentation and practice modes, can stand alone as preinstructional resources, although claiming that few studies have been done to examine the effectiveness of such simulations.

The purpose of this case study was to develop, administer, and collect student data on learning cycle lessons that use simulations in all phases of the cycle (but not necessarily in every phase of every lesson). Initially, simulations were used only in the invention phase, allowing students opportunity to become familiar with the resource. In subsequent lessons, simulations were integrated into the expansion phases and exploration phases. One later lesson employed the use of simulations in all three phases.

Method

Participants and environment

In this case study, 14 upper elementary and 17 middle school science students were observed, along with their teacher, using simulations as they engaged in learning cycle lessons revolving around river ecosystems. The ages of participants in this study ranged from 9 to 13 years old and, according to their teacher, they exhibited a range of disabilities. The students, who go a private school with a philosophy based on Gardner's (1993) theory of multiple intelligences, display a seemingly disproportionate number of special needs. The teacher reported the following issues for seven of the participants:

- Student 1 has a genetic disorder and, according to family doctors, would never learn to read or write, but can do both.
- Student 2 has speech and learning disabilities, takes speech lesson once a week, and has weak, small muscle control.
- Student 3 has Asperger's Syndrome, a form of autism, is socially unskilled, and tends to view the world literally.
- Student 4 has a serious form of dyslexia.
- Student 5 has attention deficit hyperactive disorder.
- Student 6 has severe attention deficit disorder.
- Student 7 works with a specialist on slight deficits in short and long term memory and writing skills.

The teacher has taught science and mathematics for more than 20 years, mostly in her home country, Colombia, at an American school. Her recent experiences teaching in this country have involved her first intensive use of computer technology. This study was her first experience using simulations in a science classroom setting and her first attempt at doing action research. Having recently completed her master's degree in science education in a constructivist science education program, the teacher was familiar with the advantages of using learning cycle lessons in the science classroom.

The classroom environment in which this case study took place can be considered above average as to technology use and access. The school suggests that parents provide students with laptops to use in the classes and at home. While it is not required that they have them, many do. During activities requiring the use of computers, those students who have their own computers use them, sharing with their classmates, while other use desktop computers provided by the school. The classrooms all have Internet access, including wireless access in the teacher's classroom, which is used by students with laptops and wireless cards. For this study, sufficient numbers of CDs with the program were available so that students could work in small groups, most often in pairs.

Activities and Data Collection

This case study involved action research by the teacher working with the (university) researcher. Initially, the university researcher administered learning cycle lessons that he developed.

Data collected included videotaped sessions of students using the simulations, teacher journal, student field logs, student concept maps, student and teacher interviews, and products of student activities. The students were assessed for their understanding of concepts during and after completing the learning cycle lessons. The students also completed three surveys that were developed and administered by the teacher. Two surveys focused on student experiences with computers, student beliefs about the usefulness of computers, and how they like using computers. A third survey focused on use of the *Nardoo* program.

The teacher-administered surveys mainly provided attitudinal information on the use of computer technology. As in many such surveys, students reported a wide range of attitudes about their competence and confidence in using the technology, as well as the perceived advantages and disadvantages of using it. Because of the range of competence, those students who are the most computer literate found the exercises easy and finished quickly. Those students on the other end of the competency scale, found the computer-based tasks somewhat intimidating, even when they were able to complete assigned tasks successfully. Some students preferred to use computers for all their school activities while others felt it was more efficient and easier to use pencil, paper, and print resources, as opposed to computer programs and the Internet.

This case study mainly covers results from four learning cycles developed by the university researcher and additional activities developed by the teacher to follow-up on the learning cycle lessons, especially related to transfer of learning from simulations to real-world activities. The first learning cycle lesson developed by the university researcher employs the program simulations in the expansion phase, which allowed the students to develop understanding of the concepts before using the simulations (e.g., de Jong et al., 1999). After the exploration phase, which gets at the students' prior knowledge of biodiversity and ecosystem concepts using a KWL chart (Egan, M. (1999), the students did the first activity on biodiversity from the classroom edition materials (Rapose, Cesaro, Poirier, Collins, Toppi, & Plante, 1997). The students related this activity to their school environment to help them develop working, or operational, definitions of the concepts. They collected data in tables and wrote their working definitions.

For the expansion phase of the first learning cycle, the students did the second biodiversity activity, using the CD simulation of the river ecosystem. For most of the computer-based activities, students worked in small groups of two or three. To reduce the anxiety of using the technology for the first time, the activity was treated as a contest to see who could find the most organisms in the different ecosystem zones. As an expansion phase activity, the use of the simulations allowed the students to relate biodiversity concepts studied during the invention phase to the simulated river ecosystem. The students discussed their findings and their ideas for differences in zones before completing the KWL chart (what was learned) to finish this lesson.

In the second learning cycle, the students worked with simulations in the invention phase, using the simulations to construct knowledge about food chains and webs. In the exploration, they began another KWL chart and then, in small groups, they created food webs (concept maps) by making connections (links) between organisms (picture cutouts). Their arrangements represented their prior knowledge on the relationships among the organisms. Before gluing pictures, the groups discussed their food webs and made adjustments to begin the invention phase. They then went to the CD to study organisms and their relationships in the simulated ecosystem. They created tables to collect data on the organisms they found. After sufficient time interacting with the simulations, they gathered as a class to discuss findings and reach a consensus about the relationships among the organisms and diversity issues.

To begin the expansion phase of the second learning cycle, the students created food webs based on the simulated ecosystem findings (new concept map). Comparisons between initial concept maps from the exploration phase and the new maps showed much greater complexity in numbers and linkages (The students were asked to make predictions of changes in population numbers based on their webs. They then completed the KWL chart (what was learned) and wrote an essay in their field logs about organism interdependency using their food webs as a resource.

The third learning cycle lesson focused on algal blooms without using the CD simulations. The teacher guided the students through this lesson. After exploring students' prior knowledge on the topic, the students used print resources to find out more. They observed algae under microscopes and sketched and labeled what they saw. A class discussion summed up the invention phase. In the expansion phase, the students began an experiment involving growing algae under different conditions (with or without added nutrient). They recorded their observations in data tables over the next few weeks counting algae in drops from the different samples under microscopes. At the end of the observation period, they compared the results and discussed them in relation to sources of nutrients and effects observed in the Nardoo ecosystem up to that point.

In the fourth learning cycle, simulations were used in all three phases (see appendix). This fourth lesson focuses on water quality issues, especially human impact. In the first phase, the small groups of students used the CD to explore the meaning of water quality and the water quality index. They discussed their findings with the whole class. In the invention phase, the discussion continued, focusing on the factors used to develop a water quality index. The students were told that they would apply the knowledge gained in this lesson to measure water quality in the environment nearby. The students created tables to collect data from the CD simulations and they were guided in the use of tools for collecting that data. After sufficient time, they gathered as a whole class to discuss their findings. They wrote about the results in their field logs.

In the expansion phase of the fourth learning cycle, the students used the CD simulations again to complete a research table on sources in the river ecosystem zones that affect water quality. After allowing sufficient time to collect data, the students gathered as a class to present findings and discuss environmental factors affecting water quality. The students compared the different ecosystem zones, representing different levels of human impact, and discussed the implications. To complete the lesson, they added to their comments in their logs. In subsequent activities, the teacher had the students experiment further with algae, using the classroom edition materials and the CD. The students used the simulation tools to collect and graph data on a variety of variables. One of the culminating student products was the creation of educational brochures to inform fictional communities on various water quality problems in those communities, including suggestions for resolving the problems.

Results

Often, just a difference in curricular resources, especially when technology is involved, results in improvements in students' attitudes about learning. Such was the case with the following student:

> "It has been very rewarding to see that the student, who normally has difficulty staying on task during a normal class period, absolutely loved the CD" (excerpt from teacher report on the study).

The teacher goes on to say, "I have obtained better results from the students that never do homework from the projects derived from the material from the CD."

In this case study, student results and teacher self-reporting showed that the use of simulations in learning cycle lessons provided a meaningful learning experience for both the teacher and the students.

> "I was excited about using simulation software in my classroom. I learned along with my students to use the CD. The *Nardoo* CD gives an accurate view of the effects of human activity on the ecosystem of a river. It is done in a very interactive form, in which the students constantly have to search for the answers. They had to go in the river sites and also into the information file cabinet" (teacher report).

As mentioned in the data collection section, the results of pre-instructional and post-instructional concept mapping showed a richer variety of concepts and increased linkages among those concepts (e.g., Robinson, 1999; Gabel, 1999; McClure, Sonak, & Suen, 1999; Hurwitz, Abegg, & Garik, 1999). Overall, the teacher observed the following:

> "I did not have a very clear picture of how much they were going to gain from this study, but in my opinion, surprisingly, in their assessment, they showed

> evidence of good understanding of the concepts. In particular, the one on pollution. . . Using the learning cycle with simulations I think gives the student better chances to gain more concrete knowledge. Their inquiries can be self-answered by searching in the simulation. It is a hands-on activity and, at the same time, they are being active learners."

The teacher also was better able to bridge student understanding between print materials and simulations and real-world experiences:

> "They like the presentation of the material and how realistic it became if you were thinking of an actual river case scenario. . . . In the particular case of the study of the algal bloom, it was great to see the changes in the river when you alter the quantities of the chemicals. This way they could visualize their understanding. They would not be able to see this type of situation in a normal setting, unless it is happening. . . . Now that the students are familiar with terminology and they also have much broader information on the topics covered, it will be much easier to go out in the field and perform actual measurements and experiments."

In one early example of transferring knowledge to real world situations, the teacher reported the following:

> "One of the activities outside of the classroom, at the school park, students measured a square meter area as their site to start studying the biodiversity of the school grounds. They have recalled the vocabulary used in the CD and they seem very familiar with the process to follow. During the activities in the CD, they had to really search for the animal population. During one of the activities at the school's park, one of the students' comment was 'finding a bug here is as hard as in the Nardoo.'"

Conclusion

This case study, thus, provides an example of the effective use of simulations in learning cycle lessons for upper elementary and middle school students engaged in environmental studies. The *Nardoo* program conforms to all aspects of the simulation definition that Hargrave and Kenton (2000) derived from the research literature: "A nonlinear and manipulable model, representing a real or imagined phenomenon, that has the ability to present, either visually or textually, the current state of the model" and that allows the user "to track his/her progress within the model and provides feedback in realistic forms" (p. 48).

Harper and Hedberg (1997) caution that constructivist learning situations may require students to have developed organizational skills or they will not do well in a cognitively complex learning environment (see also Windschitl & Andre, 1998). In their efforts, the developers stuck to the basic constructivist question, "How can we best support knowledge construction?" realizing that the learner will only extract from a program "what sense they make of it, not what the designer intended" (Harper & Hedberg, 1997, p. 6). Even though this program was developed from a strong pedagogical base (Harper & Hedberg, 1996, 1997), how students learn through its use in the given circumstances remains unknown (Jackson, 1997; Snir et al., 1995). Developing constructivist-based learning cycles, as described in this case study, provides one method for facilitating students in using the simulations. An anticipated outcome is to have the learner in control of the learning process, a major characteristic of discovery learning (de Jong et al, 1999).

As mentioned in the section on study participants, many of the students had special needs. One of the students, the one with Asperger's Syndrome, has difficulties staying focused on the classroom tasks. However, the student thrived in working with the CD simulations. Wanting to learn more, the student made arrangements to borrow the CD to use at home during the spring break. The teacher also reported on the advantages of using simulations for being able to study relationships among many variables within a short time frame, as well as the opportunity for students to interact with models—and develop their own models—in very much the same way as engineers and research scientists. She referred specifically to the students' ability to work with the many variables affecting water quality, obtaining results within minutes that would take hours or days to accomplish in real systems.

While many researchers agree that simulations should not or cannot replace students' hands-on experiences (Richards, Barowy, & Levin, 1992; Snir, Smith, & Grosslight, 1995; Coleman, 1997), simulation models can lend much greater efficiency to experimentation. A simulation that runs in minutes instead of the several days or weeks required by physical methods allows students greater efficiency and enables them to investigate many more variables (Snir et al., 1995; Coleman, 1997). Additional advantages of simulations include allowing students to perform virtual experiments that otherwise would be too dangerous or expensive (Windschitl, 1998; Steed as reported in Jonassen, 2000).

The teacher also reported that, in using simulations, a teacher does not have to worry about the students experimenting with potentially harmful chemicals—at least in their initial experiments. One of the advantages of the simulations is that students can gain experience with the tools and chemistry that can be transferred to experiments using real materials. The teacher also remarked on advantages of using simulations when the real equipment, materials, and assistance just is not available for classroom use.

The teacher, reporting on her thoughts during the study, discussed the difficulty veteran teachers have in changing teaching practices, especially when it comes to learning to use technology. She discussed the importance of doing hands-on labs with students, as well as the advantages of combining these with appropriate simulations, as discussed in the research literature. She remarked on the importance of depth in learning that could be achieved through the use of appropriate tools and resources.

According to Linser & Naidu (1999), the use of simulations for problem-solving activities in a context can provide effective situated learning experiences for students (see also Lave & Wenger, 1991; Harper, Hedberg, Wright, & Corderoy, 1995; Looi, 1998). Problem-oriented simulations help develop students' higher order thinking skills and improve cognitive strategies for recall, problem solving, and creativity (Vennman, Elshout, & Busato, as reported in Gokhale, 1996). In addition, Gokhale says "simulations that employ an array of media will help bridge the gap between learning styles of students and teaching styles of instructors" (p. 37). Roberts et al. (1996) recommend three strategies for integrating science simulations into classrooms:

- Teacher education courses must include science simulations as an important science learning tool.
- Science education faculty must be sensitive to the delicate balance between direct teaching and student exploration.
- Science educators, by involving their students in computer simulations, must develop ways to model this dynamic balance in their preservice and inservice courses (p. 55).

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Appendix

An example of a learning cycle using simulations in all phases.

Learning cycle lesson plan four: Human impact on water quality

Exploration

Objectives: Students will be able to develop an operational definition of water quality using the CD resources.

Materials: Exploring the Nardoo CD

Procedure:

- Ask students what they think water quality means.
- Ask them what they think might determine/affect water quality.
- Ask why water quality might be important.
- Have students in pairs go to the Nardoo CD and enter the "Water Research Centre."

- They are to click on the "computer" in the Centre and search for information on "water quality" and "water quality index."
- The students should take notes on what they find. The instructor can assist students in using the notes module to grab relevant information. (Be sure that they are familiar with the "linked media" button.)
- When a student finds a good article, have her or him give the title so that the rest of the class can look at it and take notes. They can save notes to the computer drive for later use.
- Allow sufficient time for the search and then have each pair report to the class on what they have found.
- Ask how the information they found on the CD added to what they thought was involved in determining water quality.
- Get a class consensus on the definitions of water quality and water quality index.
- Ask how they think the factors that determine the water quality index can be measured.
- Ask students where in the community they would like to determine the water quality index (and why).

Evaluation: Instructor will monitor student participation in expressing ideas about water quality before and after using the CD. The instructor will monitor student participation and cooperation in using the CD and taking notes on their findings.

Invention

Objectives:

- Students will be able to use an environmental simulation to investigate water quality issues.
- Students will use a simulation to improve their understanding of water quality and its impact on organisms.
- Students will be able to use a simulation to develop an understanding of the impact on water quality as a result of a particular human activity.

Materials: Exploring the Nardoo CD

Procedure:

- Review the significant information found on the CD. Discuss the way to determine the water quality index based on life found in the water. Ask the students if they think they could do this same measurement in a real water source.
- Discuss the factors that determine water quality involving the water itself (salinity, turbidity, and phosphorus. Tell the students that in the near future they will make measurements to obtain the water quality index of nearby water using these factors but, for now, they will practice determining water quality using the CD and studying organisms in the Nardoo River.
- Instruct the students in creating data tables that includes the following column and row labels:

Table A, Blackridge & Merringurra Regions—Zone 2, column 1 heading, "Organisms"; column 2, "Upstream"; column three, "Adjacent"; and column 4, "Downstream." Under "Organisms," rows should be labeled "Very sensitive," "Sensitive," "Tolerant," Very tolerant," "Water quality index," and "Water quality."

Table B, Blackridge & Merringurra Regions —Zone 1, same column and row labels as in Table A.

- Ask the students what they think is involved in extracting sand and gravel and why that is done. Ask if they have seen such an operation, where, and how did it look.
- In their pairs, have students go to Zone 2 of the Blackridge & Merringurra regions on the CD.
- Have them select the "tools" button and the click on "stream quality."
- They are to determine the stream quality for three areas of the Blackridge region for this time zone. The first area is upstream from the sand and gravel operation, the second area is next to (adjacent) this site, and the third area is downstream from the site.
- Have them record their data in the Table A. Instructor assists students in collecting data.
- Next, have them do the same for Zone 1 of the Blackridge & Merringurra regions (a time before the sand and gravel operation), testing the stream in the same three locations.
- Have them record their data in Table B.
- After allowing sufficient time for data collection, bring the students together again and ask them to compare the types of organisms found before and after the operation extracting sand and gravel.
- Between which areas is the change the greatest?
- Ask the students how significant they think the impact in water quality has been as a result of the sand and gravel extraction operation.
- Have the students describe their findings and ideas about water quality in their science journals.

Evaluation: The instructor will monitor student participation in creating data tables. The instructor will monitor student participation and cooperation in using the CD and recording data in their tables. The instructor will collect completed data tables to evaluate for thoroughness of collected data. The instructor will review journal entries for understanding of water quality issues and thoroughness of content.

Expansion

Objectives: Students will be able to use an environmental simulation to describe several additional ways in which human activity has an impact on water quality.

Materials: Exploring the Nardoo CD

Procedure:

1. Review factors that affect water quality (salinity, turbidity, and phosphorus).
2. Have the students create a research table with the following categories:

Type of Impact: Sewage

Causes: (leave sufficient space for data)

Effect on river: (leave sufficient space for data)

Type of Impact: Nutrients

(same subcategories for this and all of the following types)

Type of Impact: Toxic Substances

Type of Impact: Sediment

Type of Impact: Channel Alteration

Type of Impact: Flow Changes

3. Have students go to the PDA on the Nardoo CD and click on Zone 2 of the Blackridge region.

4. Have them navigate the Nardoo River through all four regions using the cursor icon to look for news stories involving the impact of human activity on the river. They should focus their research on the categories in the research table they created.

5. The students can use the notes module to grab relevant information and review it for adding to the research table.

6. Have the students repeat this procedure for Zones 3 and 4.

7. After allowing sufficient time for the students to collect data, bring the class together to discuss their findings.

8. Ask the students what kinds of human activity have caused sewage to be deposited in the Nardoo River.

9. Ask the students what kinds of human activity have raised nutrient levels in the river. Ask them what adverse effects these nutrients have had on the river. Remind them of their study of algae and nutrients.

10. Ask the students what kinds of toxic substances have been found in the river and what these have done to it.

11. Ask them what kind of human activity has deposited sediment to the riverbed of the river. Ask if this activity has any negative impact on the river and have them explain why.

12. Ask the students if the Nardoo has undergone any kind of channel alteration and, if so, how has that impacted the river.

13. Ask them if the Nardoo flow has been affected by human activity and have them explain how.

14. In each of the above cases involving types of impact, have the students compare the three zones and explain the differences among them.

15. Have the students add to their ideas about human impact on water quality in their science journals.

Evaluation: The instructor will monitor student participation in creating the research table. The instructor will monitor student participation and cooperation in collecting data using the CD. The instructor will collect and evaluate student data tables. Review science journals for understanding and thoroughness of discussion.

Connecting Across Many Divides: Digital, Racial, and Socio-Economic

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Introduction

As Internet usage increases nationally, it becomes more apparent that the Digital Divide—the gap between those who have information access and those who do not—is related to demographics. The U.S. Department of Commerce reported in its "Falling through the Net" series of studies that only 23.5% of African-American households have Internet access at home as compared with whites (46.1%) and Asian-Americans (56.8). Although the number of low income and ethnic households that have Internet access is increasing, the Digital Divide is expected to widen because access continues to be tied to income. The U.S. Internet Council and the International Technology and Trade Associates (2000) estimates that fewer than 50% of households with incomes below $15,000 per year (19% of Americans) will have Internet access by 2005. Consequently, many poor inner city and rural children will be excluded from the benefits of Internet access at home and continue to fall behind in the emerging knowledge economy (The Web-based Education Commission, The Power of the Internet for Learning: Moving from Promise to Practice).

The fundamental barriers to Internet access are lack of a computer and peripheral technology (a modem, telephone line and Internet Service Provider). However, WorldGate Communications, Inc., has developed a technology to remove these barriers. The innovation is called WISH TV℠. WISH, which stands for WorldGate Internet School to Home, gives students, parents and teachers Internet access through a television set and a cable set-top converter. No computer, modem or telephone line is needed. In this way, WISHTV is unique because it allows users to access the Internet through their television sets and as a result, extends Internet availability to virtually all children in their homes. This is especially important for students whose socio-economic status inhibits Internet access through any other means.

WorldGate Communications, Charter Communications, and Motorola are sponsoring this initiative. The service includes full Internet access and e-mail for students, their parents, and their teachers. In December 2000, seven schools in four districts in Louisiana, Illinois and Ohio implemented WISH TV as an educational initiative to provide 4th grade students in poor communities with Internet access at home and in school. Students and their families are receiving the service at no charge for one academic year.

This article focuses on the implementation of WISH TV in the community of Belle Rose, Louisiana. Belle Rose is located in Assumption Parish (county). Residents in Assumption Parish are poor—26% live below the poverty level as compared with 15.7% nationally (1998-1999 District Composite Louisiana Department of Education, February 2000).

Forty-three percent of adults have less than a high school education. Thirty-two percent of the residents are Black, 67.1 are White (1990 U.S. Census). Although some of residents in this community live in poverty and are undereducated, they, like most parents, want their children have equal access to educational opportunities.

Project Design

Initial Steps. In early 1999, U.S. Congressman Billy Tauzin (R-LA 3rd) noted that only 18% of the households in Louisiana had Internet access. Since then, the percentage has increased to 30.2%; however, only Mississippi (26.3%) and Arkansas (26.5%) rank lower nationally (National Telecommunications and Information Administration, *Falling Through the Net*). Congressman Tauzin asked WorldGate Communications to pilot WISH TV in his congressional district. A Task Force consisting of local ministers, teachers, school administrators and university professors was formed to guide all aspects of implementation. One of the biggest concerns focused on "acceptable use" by the students and their family members. Concerns ranged from the possibility that a child might run up a big bill on his mother's credit card, or a relative would use WISH TV to access inappropriate Web sites. To overcome these obstacles, parents were asked to attend an orientation meeting and sign an Acceptable Use Policy pertaining specifically to this project. Also, WorldGate Communications implemented a filter to block inappropriate Web sites. As a sign of support, the ministers addressed the importance of this innovation with their congregations, and WISH TV was installed in the community rooms at their churches.

Project Objectives. The project's objectives are to:

- Assist teachers in developing Internet activities that incorporate state standards
- Increase student achievement in language arts, math, science, and social studies
- Increase technology proficiency levels of students
- Increase completion of homework through Internet-based assignments
- Strengthen communication and cooperation between home and school via the Internet
- Increase parental awareness of the benefits of Internet usage for themselves and their children

The service has been installed in classrooms and homes of the 4th grade students and their teachers. The Louisiana Task Force chose to implement WISH TV in Grade 4 because these students take the Louisiana Educational Assessment of Progress (LEAP 21) high stakes test. The LEAP Test is aligned with content standards, which by law must be as rigorous as the national assessment of educational progress (NAEP). Fourth grade students, who do not pass the LEAP Test either during the regular school year or in summer remedial programs, cannot be promoted to the fifth grade. Consequently, the Task Force targeted Grade 4 to provide students with increased opportunities to strengthen academic skills.

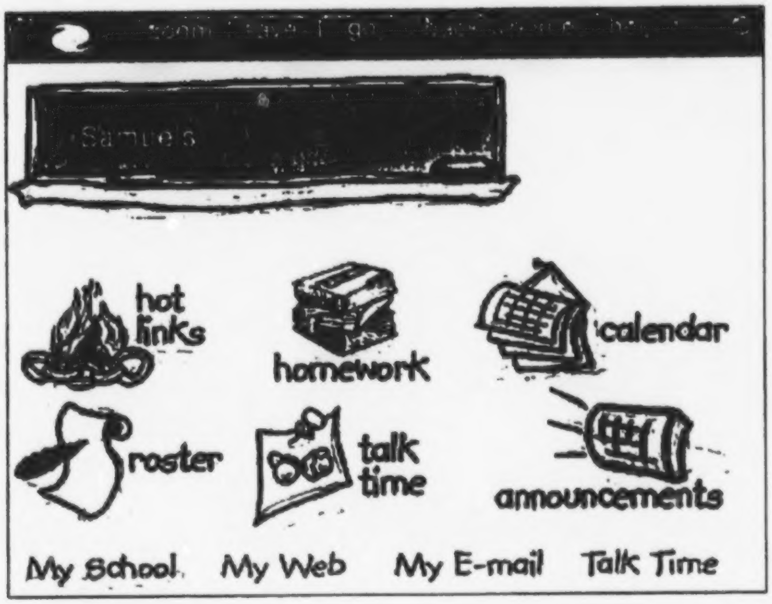
Implementation of the Design. Teachers in Louisiana are participating in a statewide professional development initiative called In-Tech, to learn to integrate technology into instruction. As part of this training, teachers are encouraged to develop lesson plans that require students to locate, synthesize, and apply information from the Web. Through In-Tech, the 4th grade teachers in the WISH TV project are able to locate current and relevant materials on the Internet. However, teachers have not been integrating Web resources into instruction because so few students had access to the Internet at home. Although the classrooms are wired, each classroom only has four computers available. As a result, these fourth grade teachers were not incorporating the Internet into instruction regularly.

Teacher Training and Involvement. Belle Rose has four fourth grade teachers and each specializes in a core subject area. Students change classes for these subjects, so they have all four teachers each day. Miss Pizzalato and Miss Aubert are recent graduates of teacher education programs, and they are comfortable using computers. Miss Parker is a veteran teacher who is anxious to offer her students the very latest, and she is also computer literate. Ms. Heims, a teacher who came out of retirement to fill a vacancy this year, was leery of the technology. However, she was willing to learn and the other teachers and her students taught her how to use the Internet, post homework assignments, and send and respond to e-mail messages. She said, "Oh, I can do it now! I sit on the edge of my bed with my keyboard and type away." As a result of this project, the teachers are planning together and sharing ideas for using WISH TV in their content areas.

Instructional Uses. The WISH TV interface is easy to use. Once teachers locate Web resources, they enter the URLs directly into the Hot Links section from home or school. Teachers and students are using WISH TV to find Web sites that contain pertinent information about the topics being studied. For example, students were studying about rocks in science class. During class, the teacher located and posted web sites for the students to use to complete their homework assignment. That night, several students searched for additional sites about the topic and shared these with their teacher and classmates the next day. The interface also includes a discussion board titled "Talk Time." Here, teachers post discussion questions, and students respond from home or school. Teachers also are posting homework, sending messages to parents to keep them abreast of their child's conduct and academic progress, and posting class announcements to inform parents of upcoming class projects and school events.

Home Connections. From home, the children and their parents access WISH TV interface through a wireless keyboard to check homework assignments, access accompanying hot links, or to complete homework and quizzes. WISH TV includes e-mail which enables students to send messages to classmates or to their teachers for further clarification on assignments. Parents are using e-mail to write to friends and relatives, teachers, and school administrators. In addition to these functions, parents can access the school calendar, check announcements and homework. Parents also can surf, explore job opportunities, and find products, services, and local community information.

Equal Access. In addition to providing equal access through WISHTV, access is uniform. In other words, the interface is seamless—it is the same at home as it is at school. This eliminates cumbersome technical barriers for children at home and consequently, WISH TV becomes another tool that students use routinely for instruction.



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Methodology

Researchers at Louisiana State University have been studying the effects of WISH TV on fourth grade students' behavior, attitudes, and motivation to learn at Belle Rose Primary School in Belle Rose, Louisiana. Initial interviews focused on:

- How are teachers integrating WISH TV into their teaching practices?
- How are students and parents using WISH TV at home?
- What changes have teachers, parents and students noted since the program began?

Seventy-six fourth grade students attend Belle Rose Primary. Sixty-six are African-American and ten are white. Ninety-two percent of Belle Rose's students are eligible for a free or reduced lunch. Only four 4th grade students had access to the Internet before WISH TV was installed in their homes.

Data Collection and Analysis. Data were gathered through guided interviews with 15 students, their parents, the four 4th grade teachers, and the principal during February 2000. The interview questions for students focused on how they were using the Internet, the average amount of time they used the Internet per day and their general reactions to use. Their parents were asked to describe changes in their behavior in regard to Internet use, changes in their children's behavior, and the impact WISH TV was having on student achievement. Teachers were asked to describe changes in their teaching practices in regard to Internet use, changes in students academic progress, changes in students attitudes, motivation to learn, and classroom behavior in general. The principal was asked to describe her impression of WISH TV, the impact the project was having on the students in her school, and any changes she had noted in students' behaviors. Data were analyzed using the constant comparative method to determine emerging themes and patterns.

Discussion

This section presents emerging themes from interviews with parents, students, teachers, and the school's principal. These interviews were conducted after the service had in place in homes for two months.

Parents. Some parents were apprehensive about installing the Internet into their homes. They were concerned that a cost would be associated with it. They were also concerned that someone might try to harm their children via e-mail. At the Parent Orientation, school administrators, representatives from Charter Communications, and the ministers explained that Belle Rose Primary was piloting WISH TV and the service would be provided free of charge for one year. School administrators and the ministers also encouraged parents to monitor their children's Internet activities and urged all students to report strange e-mail messages to adults.

During the interviews, parents expressed delight with the service because it made communication with the school very easy and allowed them to be involved in their children's schoolwork in unobtrusive ways. For example, DonTracy's father said that every day after school his wife will ask DonTracy what he has for homework that night. Every day, the response is the same, "Nothing." DonTracy's father laughed as he explained:

> I go to WISH TV and look at the homework assignments. He's not getting away with anything anymore. I wish my older son's teacher was participating in this project. Actually, every parent needs this.

Many parents noted changes in their child's completion of homework assignments because students like using the Internet to complete assignments. Also, parents are aware of assignments now and are making sure their children completed them. Both parents and their children expected higher grades because students were completing their schoolwork. Parents responded that their children also were using the Internet to search for additional information about school topics on the Web and were sharing this information with teachers and classmates. In general, parents noted that their children were excited and more interested in school because of WISH TV. In addition to completing assignments and searching for information, children are sending e-mail messages to each other, completing practice exercises for standardized tests, and playing games online. Parents estimated that children were using WISH TV between five and 16 hours per week.

Parents commented that their children were teaching them to use e-mail and the Internet and they are checking the weather online and searching the Web for information. Several parents expressed concern about what will happen to the service at the end of the year because their children are active users and have come to rely on the Internet for information and entertainment. Realizing that the fate of this pilot project is uncertain, some parents have begun to explore alternative ways to access the Internet so that their children can continue to be Web users.

Students. Changes in the students' behaviors were surprising to everyone, including the students themselves. As recommended by the Task Force, the service was installed in the students' homes, but to get a keyboard, their parents had to attend the orientation and sign an Acceptable Use Policy. About a week's time separated the installation and the Parents' Orientation. During that week, one fourth grade boy figured out how use the remote control to access a virtual keyboard on the TV screen. This allowed him to access the WISH TV service and send e-mail messages to his classmates. Word spread, and everyone was sending e-mail messages to each other before they had keyboards. Systems designers were astounded because the virtual keyboard function is very difficult to access or use.

Every student replied that they are using WISH TV to complete homework assignments. Students also acknowledged that their parents were helping them with assignments, and both fathers and mothers shared this responsibility. Students felt that they were completing more assignments now and they had access to more information. As a result, they are expecting higher grades. Chaquille said that he's doing his homework now because he can find the information he needs to do it.

Students were also excited about practicing the LEAP Test online. The students realize the significance of this test and felt good about being able to be proactive in their preparation for it. Several students commented that they felt more prepared to take the test and expected to score well.

Finally, students and their parents were happy to have Internet access in their homes. In the past, they had to leave their house to use the Internet either at the library (11 miles away) or at a relative's house. Tammy said, "I'm really glad that I don't have to leave my house to get the Internet anymore."

Teachers. Teachers were amazed at the students' reactions to WISH TV. Now, homework completion is 100% and students are submitting their work via e-mail. Ms. Pizzalato said that her day begins with children on the school grounds shouting, "Ms. Pizz! Did you get my homework?" In science, she routinely posts several Web sites to access as part of a homework assignment and remarked that every night students are searching for additional Web resources to share with her the next day. She also noted that students want to use WISH TV at school all the time. She commented, "Well, during recess time, the kids stay in to working on WISH TV. They all want to get on the keyboard. It has increased their self-esteem immensely."

Miss Aubert, the math teacher, has challenged her students by posting online quizzes. She instructed her students to log onto a certain site, complete the quiz, and e-mail it to her no later than 6:30 p.m. Sunday night. Every child met the deadline. Miss Parker commented, "I would like to do my test online too. I am still learning."

All four of the teachers commented that WISH TV took a lot of time. Miss Pizzalato found that she was spending more time. She said, "Yes, it takes longer. In order for me to find something I have to spend some time, but it is worth it."

Principal. The principal noted changes in student behavior and student self-esteem. She noted that "those boys," who were always in her office, were no longer being referred. She also noticed that students were excited about learning and said that she had received several nice e-mail messages from students. She looked forward to student performance on the LEAP test and predicted that the 4th graders would score well on the test this year.

Benefits

Although it is too early to report on the impact of WISH TV, trends are emerging, and it appears that residents are beginning to feel empowered by the Internet. Although that sounds trite, parents, teachers, and the school's principal report that students are becoming active learners as they collaborate with classmates, teachers and their parents on projects and assignments. For example, for social studies, students had to research famous African-Americans, and DonTracy chose Martin Luther King. His father commented:

> You know, I have seen the picture of Martin Luther King standing on that balcony many times, but I had not seen a picture of the whole hotel with the balcony. Now I know where Dr. King was standing when it happened. That's what the Internet brought to my house.

Students report that they are completing more homework assignments, probing for more detailed information, and contributing to their own learning by sharing information and Internet sites with their teachers and classmates. Parents are learning to use the Internet through their children. One boy commented, "I'm teaching my mom and dad how to do it (use the Internet). I know more about it that they do." Additionally, parents have a reason to use the Internet—to help their children succeed in school. In this community, everyone can contribute equally and feel successful.

Next Steps

The next steps are uncertain and the partners are not sure how long the service will continue to be offered. Many parents commented that they would be willing to pay for the service if the cost was not too high. If the service is not available, some parents indicated that they would look for alternative Internet services. All parents felt that the Internet was a valuable learning tool. They were pleased with the changes they noted in their children and were happy to have had the opportunity to participate in this pilot project.

Additional Research

The research team will continue to study the adoption of this innovation and compare student performance at this school with student performance at a school that closely matches this one. In addition, teachers and principals at other sites in other states will be interviewed to learn more about usage at those sites. The research team also will assist partners in finding grant money to continue this project and expand it to other grades and schools in this parish.

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Educational Technology Professional Development Program

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Overview

The California Governor's budget for 2000-2001 included an appropriation to the California State University (CSU) system of $6,500,000 for intensive K-12 staff development on the use of technology in the K-12 classroom. This funding was intended to enable new and experienced teachers, teamed with their site administrators, to expand their knowledge and expertise in using technology in their classrooms to improve student achievement. The CSU was asked to coordinate and administer this important aspect of professional development.

To initiate the process, the CSU established the Educational Technology Professional Development Program—a program designed to encourage institutions of higher education and K-12 organizations to work together to help teachers use technology in their classrooms. This program is intended to help teachers reach the highest level of competency in the Instructional Technology portion of the Teacher Computer-Based Technology Proficiencies, as developed by the California Technology Assistance Project (CTAP) Proficiency Committee.

A request for grant proposals for the Educational Technology Professional Development Program was distributed to teacher preparation and K-12 agencies in Spring 2000. Funding began during the summer of 2000. Twenty-eight of 35 submitted proposals were funded. To enroll in a local project, K-12 schools created teams (2 or more participants) and hosted the team by paying a $1000 co-payment. Participants receive a $1000 stipend ($500 after completing the initial activities and $500 at the end of the program) for successfully completing the requirements of the program. Participants can earn university credit, also.

Purpose

The purpose of this research paper is to address the following questions:

1. How do California K-12 educators perceive their level of technology proficiency in the following areas: General Computer Knowledge and Skills, Internet, Email, Word Processing, Publishing, Databases, Spreadsheets, Presentation Software, and Instructional Technology?

2. How do various training models affect educators' perception of their level of technology proficiencies?

3. Is there a significant difference between elementary school teachers' and high school teachers' perception of their level of technology proficiencies?

4. How do teachers' perception of their level of technology proficiency affect their use of technology in the classroom?

Theoretical Framework

Researchers continue to report that there is a tremendous lack of technological proficiency among educators, and that the need and desire for educational technology development is great (ISTE, 1999; NCES, 1999; OTA, 1995; Willis, Thompson, Sadera, 1999). Both national and state standards have been established to improve teachers' technological proficiencies: the International Society for Technology in Education (ISTE) recently published the *National Educational* (ISTE, 2000), and the National Council for Accreditation of Teacher Education (NCATE), as well as several state accreditation agencies (i.e., the California Commission on Teacher Credentialing), now require teacher education programs to integrate technology instruction into their preservice programs. The California Technology Assistance Project (CTAP), a statewide organization supporting schools and districts in the implementation of technology, designed proficiency profiles aligned with state requirements set by the California Commission on Teacher Credentialing the California (CCTC) to assist in the professional development process.

Although the California Commission on Teacher Credentialing now requires that technology be integrated into preservice education, additional educational technology competencies still need to be addressed. In addition, these requirements are not applicable to California's current teachers. Some may need to take a computer course to clear their credential, but, again, research shows that such courses do little to prepare teachers to effectively integrate technology into instruction (OTA, 1995). Teachers continue to report that they feel ill prepared to teach with technology. Hence, current teachers – those that serve as mentors and role models for our preservice teachers – are at a disadvantage because they do not have an adequate technology background. The lack of technology proficient role models is a disadvantage for preservice teachers, as well as for the children in the classroom, also.

NCATE's Task Force on Technology and Teacher Education reports that the ability to effectively employ technology in the classroom will require new understandings, new approaches, and new forms of professional growth (NCATE, 1997). Schrum (1999) examines several models of professional development, noting that those with presentation of theory, clear demonstrations, practice with feedback, coaching, and on-going follow-up are more likely to produce change in how teachers use technology in their classrooms than traditional models of staff development. She describes traditional models as one-day seminars usually hosted by an expert or after school workshops that focus on "hot" topics without follow-up, support, or direction. Brand (1998) recommends that training be geared toward teachers' perceived needs and goals. '

Method

A request for grant proposals for the Educational Technology Professional Development Program was distributed to teacher preparation and K-12 agencies in Spring 2000. Responses to the request had to include an institution of higher education and at least one district or county K-12 organization, as well as other essential elements:

- Curriculum delivery of at least 40 hours of initial activities and 80 hours of follow-up/professional development
- Alignment with technology performance standards and the state academic content standards
- K to 12/University Collaboration
- Focus on School Teams

- Stipends and University Credits
- School Co-Payment
- Ongoing Professional Development
- Number of Participants per Program
- Evaluation and Accountability

Funding began during the summer of 2000. Twenty-eight of 35 submitted proposals were funded. The proposal review team consisted of ten experts in the field of teacher education and/or educational technology. Proposals were reviewed in a blind format and evaluated by at least two different pairs of experts. Due to the overwhelming requests and need for teacher preparation in technology, some of the projects were partially funded so more institutions could participate. There continues to be a waiting list of teachers interested in participating in the program.

Each of the funded proposals adhered to the requirements of the grant; however, each proposal approached the delivery of instruction and follow-up in different ways. Some offered video-based instruction; others provided educators with choices of onsite workshops; some projects relied on individual learning plans or a combination of different learning modules. Some projects dictated the content; others let the teachers determine the instruction.

Each project tracks participants' progress using the CTAP^2 assessment site at http://ctap2.iassessment.org/csu. Participants complete a self-assessment pre-test at the beginning of their educational technology professional development program and completes a post-test following the first 40 hours or module of training. During the pre-test, participants are ask to evaluate their proficiency in the following areas:

- General Computer Knowledge and Skills
- Internet
- Email
- Word Processing
- Publishing
- Databases
- Spreadsheets
- Presentation Software
- Instructional Technology

The post-test that follows the first 40 hours of instruction asks the participants to re-assess their knowledge and skills in Instructional Technology – integrating technology across the curriculum. An additional post-test, assessing all areas, is taken by the participants at the end of the required 120 hours of training. Both the pre- and post-test are available online at http://ctap2.iassessment.org/csu. Participants are assessed on their ability to integrate technology within their own classrooms, also.

Data Sources

Over 3700 educators have already participated in the initial training and have benefited from the Educational Technology Professional Development program. Projects are working with many teachers' year-round schedules to accommodate the initial 40 hours of intensive instruction. The program anticipates serving a total of 5000 educators during the first year. Tables 1 through 4 provide background information about the educators being served, as well as their schools.

Table 1. Job title.

Teacher	Administrator	Technology Coordinator	Librarian	Other
92%	2%	2%	2%	2%

Table 2. Type of credential held by participants.

Multiple Subject (includes those with additional credentials in Administration, Special Education, or Library-Media)	Secondary Subject (includes those with additional credentials in Administration, Special Education, or Library-Media)	Special Education	Library-Media	Both Multiple and Secondary	Administration	Interns and Emergency Permits
52%	31%	3%	1%	2%	2%	9%

Table 3. Grade levels taught.

K-5	6-8	9-12	Other
48%	14%	37%	1%

Table 4. School API Scores*.

Less than 400	400-499	500-599	600-699	700-799	800-899	900+
1%	16%	19%	33%	20%	10%	1%

* School API scores range from 385 to 944.

42% of participants are from low performing schools.

Results

How do California K- 12 educators perceive their level of technology proficiency in the following areas:

Participants' responses to the pre/posttest are categorized in the following categories: Introductory (little or no experience), Intermediate (some experience), and Proficient (a lot of experience). Initial self-assessment reports reveal that participants' knowledge base in Word Processing is the highest (somewhat proficient), followed by General Computer Knowledge and Skills and Presentation Software. In general, participants rate themselves as Intermediate users in all other areas, feeling least comfortable with the Internet, Spreadsheets, and Instructional Technology. Following the first 40 hours, participants did report growth in Instructional Technology (the only topic re-assessed), but it remains as one of the participants' weakest areas. Follow-up hours are designed to help teachers with integrating technology into their curriculum, as well as address participants' needs in other proficiency areas – spreadsheets, databases, Internet, and so on. Final evaluation data re-assessing all areas will be collected and analyzed throughout the year as each project concludes and again, for all projects, in the beginning of June, 2001, to determine the overall success of the program. This data will be reported at the NECC conference.

Teachers report that they do not feel prepared to teach with technology, yet the preliminary data of this study suggests that the majority of teachers rate themselves as "intermediate users" of most technologies. Self-assessment data may or may not indicate the accurate proficiency levels of educators in their use of technology. Researchers warn that self-assessment type measures are only accurate to the degree that the self-perceptions are correct and to the degree that the person is willing to express them honestly (Borg and Gall, 1989). "Intermediate" status may also reflect the teachers' ability to use the technology, but not to apply or integrate it within their own classroom. This supports the fact that participants rated themselves the weakest in Instructional Technology.

How do various training models affect educators' perception of their level of technology proficiencies?

A description of the training models can be found at http://edtech.calstate.edu. An analysis of how the different models may have affected educators' perception of their level of technology proficiencies will be presented at the NECC conference. Final data will not be available until June, 2001.

Is there a significant difference between elementary school teachers' and high school teachers' perception of their level of technology proficiencies?

Preliminary data suggest that there is a difference between elementary and high school teachers' perception of their level of technology proficiencies. The significance of this difference will be tested in June, once all of the data is available.

How do teachers' perception of their level of technology proficiency affect their use of technology in the

Teachers who generally rated themselves at "intermediate" levels of proficiency at the beginning of the program did not necessarily incorporate much technology into their classrooms. Following the training and follow-up sessions, teachers have reported "dramatic" changes in the way they thought about and incorporated technology into their instruction. For example, in a mid-year report, one director documented the following:

> Prior to the Instructional Technology Partnership program, Annemarie's experience and comfort level with computers was limited to the word processing features of Apple Works. Following the first forty-hour workshop, Annemarie now feels comfortable using the advanced features of Microsoft Office, creating newsletters, spreadsheets for grading, class lists, parent record sheets and lesson plans. She applied her knowledge of PowerPoint to create a presentation for "Back to School Night." In addition to parent presentations, Annemarie uses PowerPoint for classroom instruction. According to Annemarie, " Whenever there is any type of writing I have to do for school or home, I head straight to my computer for a professional looking document."
>
> Annemarie's use, comfort level, and sophistication with application tools increased considerably through the first module of the Instructional Technology Partnership program. In addition to using the tools for her own professional growth, she feels comfortable integrating the applications into her classroom instruction.
>
> Following Module 2 Annemarie noted that her classroom instruction changed dramatically. She commented:
>
> *"Now when planning a unit, I not only look up the topic for information, but I*

out of time. In a few weeks my students will be doing a fish and sea life unit. I'll be

> Thanks to the Instructional Technology Partnership program, Annemarie views and uses technology as an invaluable tool to help increase student learning. She is very enthusiastic about the possibilities that technology has to offer and "jumps" at the opportunity to learn more – recently attending a digital camera class offered through her district. Her confidence has soared, and she can't wait to do more.

Proficiency levels will be assessed again in June for final analysis. Preliminary data suggest that teachers need lots of experiences and guidance in the use of technology before they feel comfortable and confident in purposefully integrating technology their classrooms.

Importance of the Study

Researchers continue to report the need to better prepare educators to effectively use technology. This study will provide insight into possible methods of instruction that may help to better prepare our teachers in Instructional Technology. How each variation of training will affect the participants' perception of their level of technology proficiencies is yet to be seen. This will be recorded and compared throughout the year and presented at the NECC June 2001 conference.

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The Impact of an Innovative Model of Technology Professional Development

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The Genesis of ICED Technology-Related Professional Development Model

This paper describes participant reaction to an informal field test of the Identifying Changes, Exploring Possibilities, and Developing Technology Skills (ICED) Professional Development Model. The theoretical framework for the ICED model is drawn from three sources:

1. literature review of the change process, specifically the adoption of innovation; best practices for the professional development of teachers; and the integration of technology in the professional practice of teachers;

2. direct experience with the design, delivery, and assessment of technology-related professional development for K-16 teachers;

3. reflective dialogue regarding the conditions which are necessary for me to integrate technology in a substantive way in my own professional practice.

My development of the specific stages of the ICED model has been a slow process. It began in the mid 80's while a graduate student at the University of Oregon. The model has been significantly influenced by my studies with Dr. C. A. Bowers, Dr. Mark Gall, and Dr. David Moursund. In 1988 the framework for the ICED model was used to develop the curriculum for The Teaching and Technology Certificate program, at Hamline University, St. Paul, Minnesota. This 10-credit graduate continuing studies program is for K-12 teachers. Its success in helping teachers integrate technology in their professional practice was the basis of my 1999 NECC conference presentation and caused me to believe it could also be effective for professional development. A detailed model describing its three stages, including process activities, was completed in the summer of 1999.

Overview of Field Test Conditions and Outcomes

When the NECC 2001 proposal was submitted it was anticipated that participants would complete all three stages of the ICED model:

- Identifying Changes
- Exploring Possibilities
- Developing Technology Skills.

For two reasons this did not happen. One, there was a request from the principal of the school hosting the in-service to decrease the length of each in-service session from three to two hours. Two, it became necessary to cancel two of the in-service sessions, one in September and one in March. It was not possible to find a convenient time for re-scheduling either. These events significantly reduced the contact time with the teachers and resulted in modifications to the outcomes for each of the three stages.

While the field test was not conducted under optimum conditions it did have definite positive outcomes for both the participants and myself. First, participants expressed a desire to learn *Inspiration*, a software program integrated with in-service activities completed in Sessions 1 and 2. Teaching the ICED teachers the skills required to use Inspiration occurred in Session 3. At Session 5 three teachers reported concrete successes using *Inspiration* as an instructional aid with their students.

Another positive outcome for the participants was identification of a technology tool, for online writing assessment, that could assist them in dealing with an emerging issue in the 6th grade social studies department. The issue is maintaining consistency in using a rubric writing assessment. One ICED participant added the exploration of this online writing assessment tool to a meeting of the district's social studies department chairs.

The primary outcome for me resulted from being reflective about the difficult, time consuming nature of complex change and designing the ICED model to be an emerging process. With the limited contact time available I was unrealistic as to how many activities could be accomplished per session and did not allocate sufficient time for processing the activities we did complete. It was also clear to me that having one-on-one time with the ICED participants to deal with their individual technology issues would enhanced the ICED model.

My reaction to the Identifying Changes stage was also a complete surprise. As someone who embraces the constructivist model of teaching, I was unprepared for how difficult it was to let the choice of technology skills evolve rather than be pre-determined prior to the in-service. As the facilitator I became impatient with the process and uncomfortable with not knowing which technology skills were going to be "taught."

These intense periods of wanting to teach specific technology skills caused me to doubt the effectiveness of the ICED model. I wondered if it was possible to create technology-related staff development relevant to the evolving needs of the participating teachers. Looking back, with the limited amount of contact time I am extremely pleased with the positive outcomes we reached. Further, I believe that these outcomes provide support for the fundamental assumption of the ICED model; teachers are more likely to integrate technology if they have linked its use to their professional practice.

Setting Up the Field Test

All models need to be tested in the field and in June 2000 an opportunity to complete one presented itself. I was contacted by a part-time teacher in Hamline University's MAEd program, who is also principal of an elementary school, located in a first ring suburban of a Minneapolis/St. Paul metropolitan area. The principal, whom I will call Dr. Smith, wanted articles describing effective technology-related professional development. Dr. Smith was interested in providing these articles to her school's technology committee. During the conversation my work with the ICED model was discussed along with my desire to conduct a field test. Dr. Smith was intrigued and asked for a proposal. The proposal called for me to facilitate six 3-hour after-school in-service sessions between September 2000 and May 2001 (total of eighteen hours) and to facilitate three to four hours of virtual dialogue. Dr. Smith's teachers would participate in data collection and have the option of registration for two graduate continuing studies credits (paid for by the teacher). There was no funding to compensate the participants or me.

Dr. Smith's reaction to my proposal was pragmatic. To make this attractive to her teachers, which she wanted to do, Dr. Smith reduced the length of the after school in-service sessions from three to two hours and limited the data collection process. Dr. Smith provided her staff with copies of the revised proposal. Six teachers, in addition to Dr. Smith volunteered to participate. Scheduling conflicts resulted in moving the start date to October eliminating one of the six face-to-face sessions. Having only five shorter sessions reduced the proposed eighteen hours of face-to-face time to ten hours. In March 2001 another of our five sessions was cancelled due to the death of my father. The field test ended with a total of nine contact hours (eight hours face-to-face and one hour online); (see Table 1). There was also one unanticipated bonus for the ICED teachers.

Following the first session Dr. Smith became extremely excited about the software program *Inspiration*. So excited that I was able to convince her to purchase six copies. Following Session 3, each participant was given a copy of *Inspiration* to use on the computer located in their classroom.

Field Test Session Description

Dates	Session Content	ICED Stage	Session Content	Time
10-10-00	- Review Objectives - Brainstorm changes - Demo Inspiration/ discuss applications	- Identifying Changes	1) Presentation software 2) Carousel Brainstorming (using Claritsworks) 3) Jigsaw using Inspiration software	2
11-14-00	- Refine and prioritize changes - Select change for exploration - Explore using Internet	- Identifying Changes	1) asynchronous conferencing 2) Internet	2
12-1 to 1-31-01	- Online Discussion	- Exploring Possibilities	1) email 2) asynchronous conferencing	1
2-13-01	- Teach Inspiration and brainstorm classroom applications	- Identifying Changes - Developing technology skills	1) Presentation software 2) Inspiration 3) Internet	2
3-20-01	Cancelled			0
5-8-01	- Review demo software related to invention	- Exploring Possibilities	1) Demo software	2

Table 1: ICED Field Test In-service Session Description

The ICED Participants

The Background Information Survey was completed by the six teachers who participated in the ICED field test, but not Dr. Smith. Survey results indicated that this was a mature group of teachers with an average of 25 years of classroom teaching experience. Three were in the 41-50 age category and three in the 51-60 age category. The number of years teaching ranged from a low of 11 to a high of 31 years. Table 2 summarizes the background information for all six participants who are referred to using pseudonyms.

Table 2: ICED Participant Background Information

ICED Participant Background Information				
Participant Name	Age	Years Teaching	Teaching Assignment	Previous Tech. Professional Development Experience
Arianne	51-60	31	Grade 6	Longer term (2-5 days) provided by school district.
Emma	51-60	27	Grade 7-8, English	Short (1 day or less) provided by school district
Mary Ann	51-60	25	Grade 8, English	Short (1 day or less) provided by outside source
Barbara	41-50	29	Grade 7, English	Longer term (2-5 days) provided by school district
Lynn	41-50	28	Grade6: English, Reading, Math	Short (1 day or less) provided by school district
Maddy	41-50	11	Grade 6, Science	More than 5 days provided by school district.

The ICED teachers also responded to two open-ended prompts about their previous experience and general thoughts regarding technology-related professional development. All but Arianne responded to at least one of the prompts. Their responses (Table 3) indicated that everyone had participated in some form of technology-related professional development. Five of the six teachers (Emma, Mary Ann, Barbara, Lynn, and Maddy) made specific references to software and hardware applications that had been the focus of these previous experiences. In particular Barbara had an extensive background with a large number of technology applications and expressed the need for on-going professional development to remain an effective teacher. Emma was the only one of the six teachers who described a negative reaction to previous technology-related professional development. Their descriptions supported the conclusion that their previous technology professional developments had focused on the teaching of specific technology skills

Participant Responses to Open-Ended Technology Questions		
Participant Name	My experience with technology-related professional development is...	When thinking and/or hearing about technology-related professional development I ....
Arianne	Blank	Blank
Emma	- it is too fast, too little practice, too boring. I have had far more fun figuring things out on my own.	Blank
Mary Ann	Blank	- think of power point, digital cameras and internet access

Participant Responses to Open-Ended Technology Questions		
Barbara	- district in-service on Hyperstudio and Grade Machine - in-service by Holt-Rinehart on CD-ROMS available with our literature & writing series - graduate credit classes (years ago) on word processing, spreadsheets etc. - recent "crash course" on SASI, our new computer reporting system	- are open to knowing more - feel like a dinosaur - feel frustrated (easily) when I hit a technological "speed bump" - realize I need the training to continue to be an effective teacher for students of this new century
Lynn	- limited - I had one class on using the Internet, but haven't had much time to actually explore the Internet.	Blank
Maddy	- piloted technology standard 6th grade - currently taking Internet in the Classroom	Blank

Table 3: Participant Responses to Open-Ended Questions Background Information Survey

Theoretical Framework for ICED Model

The ICED model is based an non-linear, iterative process with a primary goal to help teachers create links between their teaching, their students' learning, and technology. The ICED model is built on the assumption that technology integration is accelerated by addressing the "cultural" notions of teaching and learning held by all teachers. This assumption is supported by the work of the Apple Classroom of Tomorrow (ACOT) Project (Fisher, C. & Dwyer, K. Y. , 1996) which found that ACOT teachers were effective in finding strategic ways to use technology in their classrooms. In their ten year review of the ACOT project Sandholtz, Ringstaff, and Dwyer (1998) support the idea that the speed and direction of the ACOT teachers' evolution was closely tied to changes in their beliefs about learning, about teacher-student roles, and about instructional practice. In my experience these ideas are frequently omitted in technology-related course work or professional development.

My experience is support by an informal survey I conducted with seventy-five NECC '99 participants. When asked to describe the "titles" of typical technology-related professional development offerings in their districts all but five responded "Using or Learning [put in the name of a piece of software or hardware]. When asked to elaborate these NECC '99 participants described the primary focus of professional development in their district was the teaching of specific technology skills.

Sandholtz et al. (1998) go on to describe how having a primary focus on the teaching of technology skills by themselves often fails to make lasting change in the classroom. These authors believe that if you want teachers to integrate technology in a substantive way then staff developers must take the following into account.

- Technology skill is necessary but not sufficient for successful technology integration.
- Technology skills taught in insolation are soon forgotten.
- Teachers learning technology skills must also be immersed in a setting that builds connections between the technology skills, teaching, and learning.

- Lasting change, that is change where the technology is not abandoned over time, only occurs if there is a corresponding changes in teachers' beliefs and values about their practice.

The ICED model acknowledges the importance of all these observations and incorporates proactive ways of addressing cultural notions about teaching and learning in each of its three stages: (1) Identifying changes, (2) Exploring possibilities and (3) Developing technology skills.

Implementation of ICED Model

Identifying Changes. This stage requires that teachers be immersed in the process of creating connections between their teaching, learning in their classroom, and technology. Various in-service activities are completed with the goal of focusing teacher experimentation/change in one or more of the following areas: assessment, curriculum design, classroom management, or teaching strategies. The facilitator uses information generated by these activities to help the individual teachers reach one of the primary outcomes for this stage, i.e. identifying something to experiment with and/or change in their professional practice.

Ideally the Identifying Changes stage also initiates the personal process of making explicit teacher's beliefs about the nature of teaching and learning by conducting an audit of their "instructional tool box." This audit is based on David Perkins' (1992) view that while learning environments are complex they can be divided into five elements or components (not all of which are always present). The following list describes each of the five components.

1. Information Bank is any resource that is a source of explicit information about topics. Examples include dictionaries, encyclopedias, and teachers.

2. Symbol pad is any surface for the construction and manipulation of symbols to support the learner's short term memories. Examples include pieces of paper, notebooks, pads, pencils, pens, white board.

3. Phenomenaria is an area that presents in miniature phenomena such as an ecosystem or other complex dynamics. The phenomenaria make phenomena and complex dynamics accessible to the exploration and manipulation of learners. Complex dynamics can include chemical reactions or exponential growth. Examples include aquarium, terrarium, ant farm, simulation games, SimCity, and Microworlds.

4. Task manager is the part of the learning environment that set tasks to be undertaken in the course of learning, guide and sometimes help in the execution of those tasks, and provide feedback regarding purposes and product. Examples include teachers in their role as managers, text-books, computer-assisted and computer-managed instruction.

Perkins also believes that by auditing a given learning environment to determine which of the components are present or absent, anyone can create a picture of the general structure and style of that specific teaching environment. In doing so, the person conducting the audit can also learn a great deal about their assumptions regarding the nature of teaching and learning. The complete process for conducting this audit is described in Appendix A.

To adjust to the reduced amount of contact time available, I eliminated the audit of the participants' instructional tool box. This is the foundational activity for addressing two of the four recommendations made by Sandholtz et al. (1997) for creating a professional development environment that

- connects the technology skills, teaching, and learning
- supports the evolution of teacher's beliefs and values about their professional practice

Not completing the audit of their instructional tool box, the primary activity for facilitating the explication of teachers' beliefs, weakened the focus on self. I believe this was the primary reason the ICED teachers choose an external focus, reading and writing, for Stage 2 Exploring Possibilities. In conversations during Session 2 the ICED teachers linked this decision to ensuring high quality results on the mandatory basic skills assessment. This outcome meant that the teachers entered the next stage of ICED with less focus than I hoped for and with fewer connections to the work they do in their own classes.

Exploring possibilities. In the ICED model this stage is meant to be the brainstorming or fact-finding phase. Teachers in an ICED experience, along with the facilitator, are in the role of seekers and evaluators of information about technology options that can help them in experimenting with or changing their professional practice. During this stage the teacher is encouraged to use both face-to-face and virtual conversations to obtain and share information. This stage is meant to be both expansive and inclusive.

Another constrain of this field test was that the virtual dialogue set for this stage was truncated. The teachers were volunteers and while attendance at our face-to-face sessions was high, in-between session participation was low. Participants described in emails, telephone calls, and in person how difficult it was to find time to explore during the school day. Dealing with the daily necessities of teaching took precedence over time for exploration. When several of the teachers were able to make the time, technology road blocks frequently caused them to abandon their exploration.

The first road block was that the majority of ICED teachers' did not have the skills to narrow their Internet Searches, most of which produced thousands of "hits". However, several ICED participants persisted even though they found sorting through the search results overwhelming. These teachers found sites describing software that might address their special needs with reading and writing. The second technology complication is that many of these sites now distribute demos by requiring the user to download them from the Internet School network security protocols prevented all the ICED teachers from doing a download. The prerequisite task of previewing software that might have helped these teachers actually experiment with their instructional environment was so absurdly time-consuming that it was abandoned. In the end I requested and provided the desired demo CD's from all the vendors identified by the teachers for use in Session 4.

The cancellation of Session 4 required using time in the last session to preview software instead of sharing participants evaluation of selected software. We quickly ran out of time for the third stage, developing hardware and software technology skills. However, we were able to situate a technology, in this case some computer-managed instruction software, in a learning context of importance to the teacher.

These teachers did identify software that they believed could help them make specific improvements in their professional practice. I was pleased that this software was not singled out due to my influence or my view that it was "the need" to be addressed or the "best solution." These teachers themselves had talked about common needs that they all faced daily and found promising tools. They had created personal reasons for moving to the stage of exploring the technology but not for learning and using it. A foundational assumption of the ICED model is that teachers become willing to expend energy to learn technology skills when they have created their own personal reasons for using it. Not having the time for the teachers to create their own personal motivation prohibited them from moving into Stage 3, except for one tool, *Inspiration*, which I had modeled during the first two sessions.

Developing the technology skills. In the third and final stage of ICED, the teacher selects a technology and learns how to use it. My role during the field test was to facilitate the learning of a technology identified as useful by the teachers and, if requested, technologies I had modeled during the in-service sessions. If for example, during the field test the teachers had selected a piece of software they were interested in learning, my role was to facilitate that process. My roles included obtaining the software and then designing an in-service session to assist them in learning to use it. Another role was to be an advocate and collaborate in problem solving when the teachers found an approach or a technology they that wanted to include in their professional practice. This was important because all six of the ICED teachers consistently talked about how there was no funding in their district to support technology innovation and seemed unsure of how to advocate for obtaining funding for their technology needs.

Field Test Outcomes

During Session 1 I used a carousel brainstorming activity to start the process of creating links between ICED participants' teaching, learning in their classroom, and technology. In this brainstorming activity pairs of participants were seated at one of four computer stations. Each station displayed a different open-ended statement. Each statement started "Brainstorm ways you would like to experiment in your classroom with" and ended with one of the following: (1) "curriculum" (2) "assessment" (3) "classroom management" and (4) "teaching strategies". For the first round of the carousel each pair was given eight minutes to respond to the statement at their station using Clarisworks word processing. At the end of eight minutes each pair rotated to a new computer and were asked to do the following: (a) read what had been written by the previous group; (b) indicate statements that they agreed with by placing a computer generated check next to it; and (c) add any new thoughts or explorations of previous thoughts.

Prior to Session 2, I categorized the results of the carousel brainstorming looking for larger themes that went across categories of assessment, classroom management, curriculum, and teaching strategies. The results of the carousel were surprising in that there was little consensus among the group except in one area: the desire to find an automated assessment process that identified the entry level reading and writing skills of their students. I felt it important during Session 2 to seek further clarification of their responses to the carousel.

The first half of Session 2 was spent having the ICED teachers elaborate on their meanings and then they prioritized the results. During the process, the group of teachers, in the presence their principal of Dr. Smith, expressed tremendous frustration about not starting the school year with a current assessment of the entry level skills of all their students in these two core areas, reading and writing. They believed that under the current system, by the time they had useable and reliable identification of these skills a significant period of instructional time had been lost. Further, these teachers felt the need for an assessment tool that would also generate individualized learning plans for each of their students. I was professional stunned. This was an innovative and energetic group of teachers. I heard and appreciated their descriptions of innovative curriculum and assignments in completed their classrooms. But, they were adamant this was the central topic to focus on. To be true to the primary assumption of the ICED model, that the technology must address a need identified by a teacher, we focused the next stage on exploring computer-managed instruction software.

This exploration could have taken many directions. I made available relevant issues of several technology journals, such as *Learning and Leading with Technology*. In addition, I suggested talking with other teachers and searching the Internet. Internet was the mode of exploration selected by all of the teachers. The second half of Session 2 was spent familiarizing the teachers with The Center@Hamline, an asynchronous conferencing system, that we would use to share the results of our exploration.

Session 2 ended with the group having made significant changes in the goals of the Identify Changes Stage. Rather than identify a change each teacher would make in their own classroom, it was a group decision to focus on exploring the Internet for software to assess and plan individualized instruction in reading and writing, specifically grammar. In retrospect, I might have anticipated this by direction by paying closer attention to the Background Information Survey completed during Session 1.

On this survey three of the six teachers described themselves as English teachers and one described herself as a English, Reading, and Math teacher. Combine this with recent changes that require every high school senior in Minnesota to pass a Basic Reading and Writing test in order to obtain a diploma. Students first attempt at passing these Basic Skills Tests takes place when they are eight graders. Announcing the 8th grade testing results is a front page media event throughout the state. In retrospect it seems obvious that teachers under such public security would combine their intrinsic interest with some way to address the "no one hides" Basic Skill Tests.

This group of teachers wanted to teach reading and writing so that their students' would pass this test and wanted to explore how technology might help them do that. As a facilitator, their decision was disappointing because it was not the direction I had hoped they would move toward. I had anticipated that the results of Stage 1 would permit me to introduce inquiry-based uses of technology rather exploring what was available in computer-managed instruction (CMI) or computer-assistant instruction (CAI). However, I was committed to following the lead of the teachers and we began the next stage, Exploring Possibilities.

During this stage the group identified two software programs that had potential for meeting their needs in teaching a heterogeneous group of students in reading and writing. Demonstration copies of this software were obtained for preview in Session 4. However due to its cancellation the previewing took place in Session 5. While neither of these products was "the answer," each had features that appealed to the teachers. My sense is that by exploring what was readily available and previewing it the teachers gained a clearer sense of how instructional technology can be effective and its limitations. In effect, the teachers felt the software offered more than it actually delivered. However it was not a dead-end exercise. This group of teachers definitely had clearer sense of their requirements and what was available. They also expressed a desire to explore the Holt-Rinehart CD-ROMS that were part of the literature and writing series that had been adopted by their district the previous year.

One thing I found it interesting that this software had been in the building for almost a whole academic year. One of the ICED teachers had attended a workshop on it provided by the publisher. Yet none of the ICED teachers, including the person who attended the workshop, had taken at look at the software prior to the ICED in-service. I speculate that the work of Session 1 and 2 had helped these teachers identify an area of their professional practice where technology might make a substantive difference. Now they had a personal reason for wanting to explore its possibilities. This outcome provides support for the importance of creating links between technology and what teachers do in their classroom.

Another positive outcome of the Exploring Possibilities stage resulted from my exploration. During this stage I invested significant time conducting Internet Searches and posting questions on Listservs asking educators for suggestions to address the concern describe by the ICED teachers. As a result I found a product that looking interesting and described it at Session 3. The description of this online writing assessment tool, *E-rater*, from ETS Technologies, got Maddy, who is also the chair of the social studies department extremely excited. She immediately felt that this online service might help solve an emerging issue in the district.

The challenge is that all of this district's 6th grade social studies students must complete a performance packet, part of the Minnesota Graduation High Performance Standards, that includes responding to a writing prompt. Unfortunately, few of this district's middle school teachers are trained in assessing student writing using rubrics. This raises the concern that this lack of experience will lead to inconsistencies across buildings in the assessment of this essay. While *E-* was an exciting product, I felt that the ICED teachers would dismiss it because of its recurring financial cost. Surprisingly, the expense factor was not taken as an insurmountable problem.

There was a completely different reaction for the group. They did not reject *E-rater* out of hand, but instead brain stormed ways in which the district could cover the expense. By collaborating across schools it was possible to find the funds and Maddy added E-rater as a discussion item to the end of year district wide meeting of social studies chairs. This had never happened in previous sessions.

In past sessions within the first five minutes of discussing an interesting technology or application of a technology (*Inspiration*, other pieces of software, buying magnetic paper to create poetry words, etc.) someone would ask about cost. Upon learning the cost the ICED teachers' excitement generally evaporated. These teachers were convinced that their school did not have the money for any technology purchases they might be interested in. Was their willingness to keep an open mind and engage in problem solving around the funding of *E-rater* because the teachers had ownership of this issue? I think the answer is yes.

A final positive outcome is that one of the technologies modeled during the field test was incorporated as an instructional tool. At our final May meeting three of the six teachers shared different ways they had used *Inspiration* with their students since the February training session. From this information it appeared that they used *Inspiration* and were getting positive results.

My Reflections

Under less than ideal conditions, some of the ICED program meet its objectives. The ICED participants identified areas they wanted to improve with technology tools (reading and writing instruction). No technology skills related to reading and writing were actually taught because we ran out of time.

A potential technology solution for a problem that arose out of the lived experiences of the ICED teachers was also discovered. Again, while no skill instruction was provided, an ICED teacher continues the exploration process with others in the district.

Finally, three of the ICED participants began to use and integrate *Inspiration* in their classroom instruction. *Inspiration* was a software that was heavily modeled in the first two ICED sessions. In those early sessions, following each use of *Inspiration* the ICED teachers brain stormed ways it might enhance their professional practice. During Session 3 some of the ICED teachers were trained (three were absent) how to use *Inspiration*. This skill training resulted in these participants using *Inspiration* in their classroom.

What I have learned

Anyone interested in helping teachers integrate technology in their professional practice must heed the warnings of Michael Fullan (1982,1983) complex change takes time and is difficult. While the initial proposal called for 18 hours of contact time, I now believe it would take 30-40 hours over a 12 month period to complete a full field test of the ICED model. While having additional contact time is essential, one must also carefully consider the setting for in-service sessions. In other words don't, ask teachers to initiate a difficult process at the end of a full day of work. The journal entry of Mary Ann eloquently describes her energy level and its impact on the activities.

> Of course, my first thought is how tired I am. Secondly, I had to avoid thinking too negatively as I was working with Arianne. My mind truly felt blocked by fatigue. At the same time it is exciting to look around the room and see what other colleagues are here and know that I have respect for each of them...... Hopefully I won't be this tired every week! I need sugar!

Initiating the process of complex change when teachers are tired is not reasonable (even though I thought it was). This field test etched in my brain the need to establish certain conditions before trying to assess the effectiveness of the ICED model.

Conditions

- Need 30 - 40 hours of contact time. This is a significant time commitment and teachers need to be compensated. I propose a combination of cash stipend and technology for use in their classrooms.
- Schedule the Identifying Changes Stage on a professional development release day or during the summer.

In addition to establishing general conditions for an effective professional development experience feedback from the field test has caused me to modify some of the ICED activities and add a new one.

Modifications of ICED Activities

Carousel brainstorming. The first activity in Identifying Changes Stage can be improved in two ways. One, first help the participants view experimentation in a broad sense. Provide some examples that relate to professional practice. For example, experiment with sharing the responsibility for assessment with the learners; or experiment with strategies to encourage independent learning. Be clear that the experimentation is something related to the general assessment, curriculum, instructional strategies, or class room management. Have the participants put any thought about technology on hold for the purpose of this activity. Doing this before the carousel activity may help participants think more broadly about the idea of experimentation and prevent a participant like Emma who describe "going blank" during the carousel activity because of a perceived limited technology vocabulary. She wrote:

> My mind is numb. I was awed that when given the chance to have a perfect world situation, I could not come up with much. I have no tech vocabulary; I didn't know much of the terminology that others had placed on the machine. Much of my focus is on getting the kids engaged in THINKING! There is so little involvement in the learning process and a certain lack of discipline. How do we instill that in kids?

The journal entry clearly describes a desire to be more effective at engaging learners; this desire was not an idea put forth by Emma during the carousel. My sense is that if the idea of engaging learners had been articulated the majority of other ICED teachers would have indicated their agreement as too its importance. Having this as part of the carousel response would have enabled me to model some inquiry-based technology enhanced activities.

A second modification to the carousel is changing the sentence stem participants respond to. Instead of using "Brainstorm ways you would like to experiment in your classroom with . . . .", the prompt should be modified to include a reference to increasing student achievement. As Gall and Renchler (1985) state one crucial condition for effective professional development is a focus on student achievement. The effectiveness of the ICED model would also be strengthen by including and individual learning plan (ILPs) as describe by Bray (1999).

Individualized learning plan (ILP). In her article "*Technology Staff Development that Works*" Bray describes eight steps for effective technology-related professional development. They are:

1. Create a team

2. Set your goals and vision

3. Identify your needs

4. Define where you are now

5. Develop a list of opportunities

6. Design and implement an action plan

7. Design and support individual learning plans (ILPs)

8. Evaluate and address the effectiveness of your action plan (p.15)

Step 7 is design and support individual learning plans (ILPs) which Bray does once teachers are aware of the on- and off-site staff development opportunities (Step 5 Develop a list of opportunities). Bray describes how using data collected about teachers perceptions of technology (attitude, skill level, personal visions, etc.) it becomes possible to make individuals aware of the staff development opportunities that best fit their needs. While I think creating ILPs is a great idea, it would be implemented differently in the ICED model.

First I will integrate the ILP in the Identify Changes Stage. Once teachers have selected a focus for their experimentation they would record in a systematic manner new skills, if any needed to engage in the experimentation; current expertise they have that supports the experimentation; and what materials support they require during the experimenting. I would also include a column for use during the Exploring Possibilities Stage. This column would be used by teachers to note technologies that could be used to facilitate the experimentation. Adding this activity to will strengthen the ICED in two ways.

One creating ILPs has the potential to provide participants involved in an ICED experience with another opportunity to create links between technology skills, teaching and learning. Two, adding a reflective component to the ILPs can also provide ICED participants additional time for making explicit their beliefs and values regarding teaching and learning. This may facilitate the changes in teacher beliefs about their practice that Sandholtz et al. (1997) belief to be essential in making permit change.

In closing I want to thank the ICED participants for providing me the opportunity to work with them. They willingness to take on the role of pioneers for intrinsic reward only was truly gratifying. Being able to work with this group of teachers, under less than ideal professional development conditions, and still achieve the positive outcomes we did, has re-affirmed for me the power of co-constructing with the learner. As Dr Smith writes in her journal from Session 2:

This session was exciting and inspiring. It was a great discovery to use the data from the previous session to generate themes and ideas to target areas of interest and need. It brought the group together as a learning community stimulating common purpose (I liked the flocking approach). It created a curiosity and a wish to learn more about the technology resources and the sharing that will be possible with each other.

I couldn't agree more.

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Appendix A

Instructional Tool Box Audit

To conduct the audit the teacher first familiarize themselves with Perkins' (1992) Five Elements of Instruction (Figure 1). Perkins believes that while learning environments are complex they can be divided into five elements, not all of which are always present. Auditing a given learning environment to determine which of the elements are present or absent allows anyone to create a picture of the general structure and the style of that specific teaching environment. In doing so the person conducting the audit can also learn a great deal about their assumptions regarding the nature of teaching and learning. The Five Elements are described below.

Five Elements of Instruction	
Element	Description
Information Bank	An information bank is any resource that is a source of explicit information about topics. Common examples found in classrooms include dictionaries, encyclopedias, and of course teachers.
Symbol Pad	A symbol pad is any surface for the construction and manipulation of symbols to support the learner's short term memories. Examples include pieces of paper, notebooks, pads, pencils, pens, white board.

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Five Elements of Instruction	
Construction Kit	A construction kit is a collection of prefabricated parts and processes with emphasis on creating structures and actions. Examples include Legos, Tinker toys, Erector Sets, Distillation Apperatus, and Lincoln Logs.
Phenomenaria	Phenomenaria is an area that presents in miniature phenomena such as an ecosystem or other complex dynamics. Examples of complex dynamics are chemical reactions or exponential growth. The phenomenaria makes phenomena/complex dynamics accessible to the exploration and manipulation by students. Examples include aquarium, terrarium, ant farm, simulation games, SimCity, and Microworlds
Task Manager	These are the elements of the learning environment that set tasks to be undertaken in the course of learning, guide and sometimes help in the execution of those tasks, and provide feedback regarding purposes and product. The best and most common examples of task managers are teachers and text books. Recently we have also seen a growth in the use of computer-aided instruction.

Figure 1. Five Elements of Instruction

Once the teacher knows what they are looking for they complete the following chart (Figure 2).

Instructional Tool Kit Auditing Sheet		
A: Element of Instruction	B: Examples found in classroom	C: What does the presence or absence of these element indicate to you about your assumptions regarding teaching and learning.
1. Information Bank		
2. Symbol Pad		
3. Construction Kit		
4. Phenomenaria		
5. Task Manager		

Figure 2: Instructional Tool Kit Audit Summary Sheet

Column A lists the element of instruction, Column B provides a place to write down examples of elements that a teacher currently has in their classroom or that they have access to. Column C is for teacher reflection. The ICED process requires teacher to think about how the results of the audit are outward symbols of their basic beliefs about the nature of teaching and learning. Once the audit has been completed the teacher can identify areas of their instructional tool box that can be enhanced.

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Middle School Students as Multimedia Designers: A Project-Based Learning Approach

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Abstract

This presentation reports a research practice of engaging middle school students to be multimedia designers using a project-based learning approach. Specifically, it addresses two questions; (1).Can a learner-as-multimedia-designer environment increase middle school students' motivation toward learning? (2). Is the middle school students' cognitive strategy use affected by engaging in the role of being a multimedia designer? The paper describes this learner-as-multimedia-designer environment in detail (the various phases, tasks, and tools). Both quantitative and qualitative data were used in the investigation. The results suggested that such an environment encourages the students to be independent learners, good problem solvers, and effective decision-makers. Engaging middle school students in being a multimedia designer can have positive impact on their cognitive strategy use and motivation.

Theoretical Framework

Engaging students as multimedia designers is one type of project-based learning, which requires students' active participation, and engages them in authentic problem investigations. Project-based learning is considered to have great potential to enhance students' motivation and learning (Blumenfeld, Soloway, Marx, Krajcik, Guzdial, & Palincsar, 1991). The notion of design is predicated by the belief that knowledge itself results from and is a design (Perkins, 1986). Perkins contended that treating knowledge as design orients teachers away from the image that knowledge is information and away from the act to transmit information. The act of design promotes active and creative use of knowledge by the learners (Perkins, 1986). In a learner-as-multimedia-designer environment, teachers follow the cognitive apprenticeship framework and take on the role of a facilitator to scaffold students' learning through modeling, inquiry, and instruction (Collins, Brown, & Newman, 1989; Lehrer, Erickson, & Connell, 1994). The design project presents students with an authentic challenge and requires students to tap into their diverse intelligences, such as artistic, logical, linguistic and musical, and talents to accomplish the task. Students are engaged in a variety of activities from brainstorming, gathering and researching information, writing, creating art works, to programming and evaluating. These activities resemble the practice employed in the multimedia industry (Liu, Jones, & Hemstreet, 1998). Researchers have proposed that engaging in these activities can help students develop thinking skills including project management, research, organization and representation, presentation, and reflection skills, and can help them better prepared for the job market (Carver, Lehrer, Connell, & Erickson, 1992; Lehrer et al. 1994).

A number of studies have documented the promising results of engaging students in the role of a designer. Spoehr's study (1993) showed that students developed more complex knowledge representations and various thinking skills through the design of hypermedia programs. Similar results were found by Lehrer and his colleagues (Lehrer, et al. 1994). In their study, ninth-grade students used a program called HyperAuthor to develop hypermedia presentations about a topic in American history for their peers as an educational tool. As a result, students significantly increased their time on-task behavior and internalized some design skills over the course of their design projects. Liu and Rutledge (1997) worked with a group of at-risk high school students as they designed multimedia projects for a children's museum. The result showed that students significantly increased their interest and involvement throughout the project. Students steadily increased their time spent on the project and became more motivated in learning than the control group. Moreover, their self-efficacy was enhanced and they obtained a more positive image about themselves. Many students reset their goals for the future—to work in multimedia design profession rather than working in fast food restaurants.

Designing such a learning environment is a complex task. While studies showed the potentials of engaging students as designers, more research is called for to understand how to construct such an environment effectively. This present study is to examine the impact of a cognitive apprenticeship-style learner-as-multimedia-designer environment on middle school students' motivation and their cognitive strategy use. The research questions are:

1. Can a learner-as-multimedia-designer environment increase middle school students' motivation toward learning?

2. Is the middle school students' cognitive strategy use affected by engaging in the role of being a multimedia designer?

Participants

The participants were students in an elective multimedia class (N=16) from a middle school in the southwestern part of the United States. There were five female and eleven male students. To get into this multimedia class, students needed to have a GPA of B and above, recommendations from two teachers and an essay describing why they wanted to take this class. These seventh and eighth graders had fairly high computer skills. Many had used software such as Clarisworks, HyperStudio, PhotoShop, and Internet. Four students were in the multimedia class for the second year.

The Learner-As-Multimedia-Designer Environment

The study took place during the spring semester of 2000. The multimedia class met every day for forty-five minutes for a total of eighteen weeks. This school offers a multimedia class as an elective for its seventh and eighth graders (such opportunity is not common for most middle schools) and the curriculum is in existence for the second year. The class had access to 5 Power Macintosh computers, 15 Dell computers, a color scanner, a digital camera, and a video camera. Professional multimedia software was available for use such as *Adobe PhotoShop, Adobe Premiere*, and *Microsoft PowerPoint*. However, not all computers were equipped with all the software and zip drives. Students needed to share the resources, and transfer files from one platform to another, or one computer to another (as some computers were more powerful than the others). The PC and the Mac labs were quite a distance away from each other. With a very tight schedule in the middle school, it was challenging for students to make full use of the 45 minutes while spending some time transferring files or waiting for their turn to get onto a computer with some specific software.

Unlike a traditional classroom, this class simulated a multimedia production house. At the beginning of the semester, students were explained about the objectives of the class, and the tasks to complete. The organization of the class consisted of three phases.

Phase I

Phase I (approximately five weeks) was devoted to learning different features of the software and creating a small multimedia presentation as a practice. The goal for this phase was to learn the tools and be able to use state-of-art multimedia software.

Phase II

Phase II (approximately eight weeks) focused on working in groups and creating a large multimedia presentation for use in an upcoming teacher job fair. Students followed a four-stage development model (planning, designing, producing, and revising) (Liu, Jones, & Hemstreet, 1998) and created a program for a real audience. During the **planning stage**, students were engaged in critiquing a similar presentation created by teachers in the previous year and in brainstorming what to create and how to make it better (the content), whom to create for (the audience), and how to proceed (the process). The class decided on different subtopics to include. After discussions and negotiations, students were divided into three teams with about five students in each team. Each team was responsible for a few subtopics. Students also determined their roles and responsibilities in the team. Following the practice in the multimedia industry, students assumed the role of a researcher, a graphic artist, a programmer, a project manager, and audio/video specialist, depending on his or her preference. Cognitive aids such as storyboard and flowchart samples were provided to guide students on their planning of the project.

In the **design stage**, the students were introduced to four basic multimedia design principles: Consistency, simplicity, legibility, and contrast. Students were presented the examples and non-examples of the four design principles. Students were also engaged in defining and refining their topic, subtopics, and the strategies to use for presenting the information. Each team created a flowchart and a storyboard, detailing the overall structure of their program and how each screen was related to each other. Teachers and researchers provided directions and offered suggestions for students' designs throughout this phase.

In the **production stage**, students realized their storyboard ideas on the computer screen. These middle school students used some of the state-of-art multimedia programs such as *Adobe PhotoShop* and *Adobe Premiere*. They scanned graphics, took pictures using digital cameras, and created images using *Adobe PhotoShop*. Students used video cameras to capture school events and converted the video clips into the digital video format. They researched their topics using a variety of methods such as interviewing teachers, writing letters to teachers/students, and searching the Internet. Finally, they assembled all elements (graphic, text, video, and audio) into the *PowerPoint* program. Teachers and researchers continued their coaching by offering suggestions on where to look for the information, how to use the software, and checking the accuracy of the content.

Like the practice in a multimedia production house, **evaluation and revision** occurred continuously throughout the four stages. Students would show their work to their team members, teachers, and/or researchers to get feedback. Revisions were made immediately. When each team completed their parts, the whole project was assembled and the class was given a chance to evaluate the whole project again. In addition, a field trip to a local multimedia production company was arranged. Students toured the company's facility and received a debriefing about the industry and the multimedia design and production process. This event provided students a first-hand experience of what it was like to be a multimedia designer and a chance to reflect on their own experience.

Phase III

In Phase III (approximately three weeks), students used the skills they acquired and worked on creating a Web site template using *Claris HomePage* for their school. While students received direct instruction and much guidance during phases I & II, such instruction and guidance were gradually faded in Phase III. Students were very much on their own, applying the skills and making their own decisions. There were some review sessions on how to use the software, *Claris Homepage*, but there was no direct teaching. Guidance and assistance were provided only as needed. While the goal for Phase II was to provide needed scaffolds for the students and helped them acquire important design skills, the goal for Phase III was to see if they could apply what they learned on their own in a new situation. Students also chose their own teams in this third phase whereas in Phase II, the teachers assigned students to teams. Student teams were in a friendly contest with each other to come up with the best template design while all teams worked on different aspects of the same project in Phase II.

Assessment of Learning

Measuring Motivation

To assess students' motivation, a questionnaire was used consisting of 26 items from the Motivated Strategies for Learning Questionnaire (MSLQ, Pintrich, Smith, Garcia, & McKeachie, 1991). The questionnaire addressed five aspects of motivation: (1) intrinsic goal orientation (Alpha=.74), (2) extrinsic goal orientation (Alpha=.62), (3) task value (Alpha=.90), (4) control of learning beliefs (Alpha=.68) and (5) self-efficacy for learning (Alpha=.93). Paired T-tests were conducted and the results are shown in Table 1.

Table 1. Means and Standard Deviations (in Parenthesis) of Motivation

	$\text{Mean}_{\text{Pre-test}}$	$\text{Mean}_{\text{Post-test}}$	T-value	Sig.
Intrinsic Goal	5.72(.77)	4.67(1.56)	2.47	p=.0269
Extrinsic Goal	5.42(.86)	4.68(1.55)	2.03	p=.062
Task Value	5.08(1.68)	6.18 (.42)	-2.62	p=.02
Control Beliefs	4.73(1.50)	5.67(1.10)	-3.39	p=.0044
Self-Efficacy	5.23 1.22	5.60 .52	-2.28	p=.039

Measuring Cognitive Strategy Use

To assess students' strategy use, four scales were selected from the Motivated Strategies for Learning Questionnaire (MSLQ, Pintrich, Smith, Garcia, & McKeachie, 1991) with regard to resource management strategies. These scales are: (1) time and study environment management (4 items, Alpha=.76), (2) effort regulation (4 items, Alpha=.69), (3) peer learning (3 items, Alpha=.76) and (4) help seeking (4 items, Alpha=.52). Paired T-tests were conducted and results are shown in Table 2.

Table 2. Means and Standard Deviations (in Parenthesis) of Resource Management Strategies

	Mean$_{\text{Pre-test}}$	Mean$_{\text{Post-test}}$	T-value	Sig.
Peer Learning	3.36(1.28)	4.39(1.11)	-2.92	p=.014
Effort Regulation	5.31(.54)	4.77(.80)	2.12	p=.057
Time & Study Environment	4.48(1.11)	3.60(1.36)	2.42	p=.034
Help Seeking	5.40(.66)	5.54(.75)	-.888	p=.393

Reflections and Interviews

Students were asked to reflect on their learning experiences during the mid as well as the end of the semester. Interviews were conducted with the students on their design and thinking process at the end of the research. Following Miles and Huberman's guidelines (1994), the data were transcribed, chunked, and coded using themes emerged from the data.

Importance of Planning and Storyboarding

It is clear that after developing the multimedia programs, these middle school students had a good understanding of the importance of planning and how to use the technique of storyboarding to lay out the ideas and steps of implementation. When asked what things were important to produce a good multimedia program, almost all students mentioned planning and storyboarding. A sample statement was "I like the storyboarding. It helped us a lot because when you started, you were clueless." Students also acquired some understanding of the need for testing. Some students commented, "If we have another project, I'd suggest everybody have fun doing it and do it faster and have time to revise it. And plan ahead so that we have time in the end [for testing]."

Time Management. The students overall had some trouble dealing with the time and environment constraints. Students commented on the difficulty of working in two different labs that were a distance away. One student said, " I didn't like that most of team weren't always in the same room. I would have to ask Bob (team leader) a question and I might end up not being able to find him." Some students recognized the challenge of managing the time well in doing the multimedia project: "If there is anything I would like to improve on the project, it will probably be the time we have to do it [the project]. If we started this a couple of weeks earlier, we probably could have really finished this off and done it nicer."

Team Work. Students agreed on the advantages of working in a group. One commented on the teamwork process: "I like having a group that was really fun. We had a good group and we all helped each other and everything." Others commented on helping each other to solve problems: "I like working with a group because it makes me feel comfortable. If you did it individually, nobody came and helped you, but in a group, somebody in your group will help you." Interestingly, a few students also seemed to feel that they did not need to contribute as much when working in a group. One student mentioned, "I think it is better that we worked together as a group because if we did it individually, it would have been a lot more work to do. Like we had three or four people in a group, we split the responsibilities. It made it easier."

Discussion of the Findings

Being a Multimedia Designer and Motivation

The findings showed that students recognized the value of learning multimedia skills, and liked what they were able to accomplish. They were particularly excited about the opportunity of learning multimedia professional software, and working like a multimedia professional, and felt confident about their abilities. One student said, "This class has to do with computers, graphics, and hard working. You have to be patient and confident to finish projects." Another stated, "That is not a class that you can do nothing and get a 100 for the grade."

The findings also indicated that these students became less interested and motivated toward the end of the semester, both intrinsically and extrinsically. The interview and observation data showed that these middle school students grew a bit bored of the same development process used for Phases II & III. Being able to get enrolled in this elective multimedia class was an honor. All participants were good students academically, earning As and Bs in their classes. Whether they were intrinsically motivated, extrinsically motivated, or both, these students were motivated toward learning from the beginning. The students considered multimedia development a new and exciting opportunity, but most of them equalized it to simply learning some software. Yet, developing multimedia programs is more than just creating graphics, sound, and video. This is an important realization for these middle school students. Multimedia design skills such as brainstorming, storyboarding, designing and testing/evaluating were new skills for the students to acquire. It was intentional that Phases II & III followed the same 4-phase model so as to provide multiple opportunities for the students to acquire and practice these skills. During each phase, a considerable amount of time was spent on the apparently "boring" tasks of planning, designing, and testing. The data showed that the students became aware of the importance of these tasks, but they did not like doing them as much as learning software programs. In addition, producing a quality multimedia program requires the developer to be detail oriented (Liu, Jones, & Hemstreet, 1998), a very difficult task for this age level. These middle school students eventually grew tired of the "long" and repetitive development process, and lost some interest in what they were doing. This finding was in line with other research showing novelty plays a role in middle school students' motivation (McGrath, Cumaranatunge, Ji, Chen, Broce, & Wright, 1997). Novelty, however, can play a positive role. The challenge for the teachers and researchers is to keep the students interested while engaging them in the more important, but less fun, tasks such as planning, designing, and evaluating (Liu & Rutledge, 1997). That is, to let the novel opportunities help keep students motivated. Another possible reason for this decreasing motivation at the end is that many students mentioned they would have liked to spend less time in doing non-computer activities. Because of the way this class was structured, students' learning time was divided between two-thirds of computer based multimedia activities and one-third of non-computer based art activities. This is a limitation to this research project, a pre-determined school curriculum that could not be changed.

Being a Multimedia Designer and Cognitive Strategy Use

To be a successful multimedia developer, one needs to be able to manage time well, meet deadlines, work well with team members, and solve potential conflicts. In this project-based learning environment, students collaborated with their team members on a continuous basis. Not surprisingly, they greatly increased their peer learning behavior. To complete the multimedia projects, students were engaged in intensive collaborative work—-they brainstormed ideas, provided support to each other, and reviewed and evaluated each other's work. There were plenty of interaction opportunities within and across teams. However, perhaps due to this reliance on peer support, the students seemed to feel that they did not need to contribute as much and work as hard. Several students mentioned that they felt more comfortable working in a group and that they felt relieved knowing that somebody else would share the work load and responsibility. This may explain why the self-perceived effort regulation decreased toward the end of the semester.

Group work is often an integral part of the curriculum in this participating school. Students seemed to have developed a strategy to identify the source of help before they took this multimedia class, which explained that the students already knew how and from whom to seek help. In addition, various cognitive apprenticeship scaffolds provided by the teachers and researchers were available during the entire multimedia development process. Students were readily assisted in their learning. This may explain why the students' help-seeking strategy remained the same, as the need for them to develop new help seeking strategies was not immediate.

Students felt they reduced their skills in managing time and study environment resources. The difference between the pre- and post- treatment scores was statistically significant. The complexities of dealing with cross-platforms and server issues, working within a group, and handling multiple equipment, space and time constraints, along with creating multimedia elements, made the learning/working environment chaotic and not as "normal". As indicated in the data, students complained about the difficulty of getting together with their group members since the group was often dispersed in two different labs some distance away. When students needed a certain file, they may have to wait for their turns as not all computers were equipped with the multimedia software or were not all equally powerful. Computers crashed and files were lost at times. Students had to deal with the lost time and equipment constraints. All these could contribute to the decreasing sense of control over their time and study environment, and influenced their ability to meet the deadlines.

Being a Multimedia Designer and Acquiring Technical Skills

An important decision in designing this workplace simulated learning environment is that the tools these middle school students used are those professional multimedia software (not simplified ones). If the students can learn to use these professional tools, they can relate this learning experience to skills desired in the workplace more easily. Most students recognized the value of knowing the software tools, and appreciated the learning opportunity. They believe what they are doing in the classroom today "will be useful in the future." Figure 1 shows some screen shots of the programs students created.

Project-based learning approach shifts learning focus from "teacher telling" to student centered "learning by doing." The challenge to create a multimedia product for a target audience serves as the central curriculum activity to drive students to learn and solve problems along the way. In a simulated multimedia house like in this case, students work like multimedia professionals, a not so common opportunity for the middle school students. The need to meet the client's requirements by the deadlines, the hardware and software constraints, the distribution of the tasks among the group and the challenge to work with others of a different personality all make the learning situation more authentic and complex. There is no ready answer to the challenge. The students have to learn just in time, tap into their multiple intelligences, and share the responsibility. Such a learner-as-multimedia-designer environment encourages the students to be independent learners, good problem solvers, and effective decision-makers. The results of this study showed that engaging middle school students in being a multimedia designer can have positive impact on their cognitive strategy use and motivation.

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Figure 1. Sample screen shots for the Multimedia Programs

Electives
Music
Physical Education
Fine Arts
Languages

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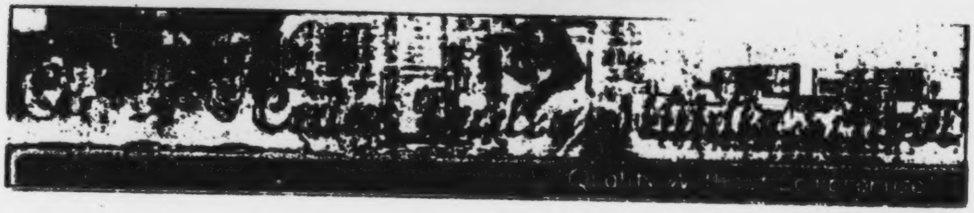

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Evaluation of a Laptop Program: Successes and Recommendations

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Introduction

The overall purpose of this evaluation study was to determine the effectiveness of providing 5th and 6th grade students in Walled Lake Consolidated Schools (WLCS) with access to laptop computers with regard to classroom learning activities, technology usage, and writing achievement.

The WLCS Laptop Program is based on the Anytime Anywhere Learning (AAL) program (AAL, 2000), which has been in schools since 1996 and has impacted more than 100,000 students and teachers. The goal of the AAL program is to provide students the knowledge, skills and tools to learn anytime and anywhere.

The Laptop Program arranged to have laptop computers available for a monthly lease fee of fifty dollars. The Laptop classrooms were equipped with wireless access to the Internet and printers. The program also provided students and parents the opportunity to receive training on basic computer skills. The Laptop teachers received ten full days of professional development prior to the 1999-2000 academic year and six one-half day sessions during the year. The training was based on the NTeQ model (Morrison, Lowther, & DeMuelle, 1999) which provides teachers a framework to develop problem-based lessons that utilize real-world resources, student collaboration, and the use of computer tools to reach solutions. The lessons are typically structured around projects, which engage the students in critically examining community and global issues, while strengthening student research and writing skills.

Research Questions

The evaluation of the Laptop Program was structured around three primary research questions that focused on classroom practices, student behavior and writing ability. The detailed questions are listed below:

- **Is teaching different in a Laptop classroom?** To answer this question, observers examined classroom practices to determine if instructional practices in Laptop classrooms were different from those in non-Laptop classes. For example, were classrooms lecture-based and/or project-based, were the classrooms academically focused and were students engaged, did teacher questions call for students to construct responses or simply recall factual information.

- **Do students behave differently in a Laptop classroom?** By observing and talking to students, observers gauged the level of interest in learning, student attitude toward one another (do they get along and are they helpful), and the degree to which students take initiative for their learning as opposed to being dependent on the teacher for constant direction.

- **Do students achieve differently in a Laptop classroom?** Observers assessed writing samples from Laptop and non-Laptop classrooms looking for both content and quality, observed whether writing in the classroom was sustained or short-term question and answer, and whether technology was used as a tool to increase the quality of work or simply for computer assisted instruction.

Design

The evaluation period extended from September 1, 1999 through May 30, 2000. The evaluation design was based on both quantitative and qualitative data collected from students, teachers, and parents involved with the Laptop Program and students and teachers in non-Laptop classrooms in seven schools (four elementary and three middle) within WLCS. Comparative analyses were completed for teaching activities and learning outcomes and descriptive analyses were completed for student, teacher, and parent reactions to the Laptop Program.

The data set for the evaluation included classroom observations, student writing test scores, student surveys and focus groups, teacher surveys and interviews, and parent surveys and interviews. Two separate observation measures were used to collect observation data: The *School Observation Measure* (*SOM*), and the *Survey of Computer Use* (*SCU*). *SOM* was based on 60 continuous minutes of observation, divided into about 4, 15-minute segments. These 4 observation periods were then summarized on one *SOM* Data Summary form. *SCU* was completed as part of the 60-minute observation sessions, only if students used technology during that time. A total of 50 classroom observations were conducted, with 32 in Laptop classrooms and 18 in non-Laptop classrooms.

The WLCS's *Writing Scoring Guide* was used to assess prompted writing samples from Laptop and non-Laptop students. A sample of 32 Laptop and 32 non-Laptop students were randomly selected to complete the writing test. Experienced reviewers used the district's four-point rubric (ranging from 1 to 4, with 4 being the highest rating possible) to conduct a blind assessment of the writing samples for Ideas and Content, Organization and Form, Style, and Conventions, yielding four scores per student.

The student, teacher, and parent surveys, interviews, and focus groups primarily focused on three areas: have the laptop computers had a personal impact (increased skills – research, computer, learning), have the laptops impacted what happens in the classroom, and what are the benefits, difficulties, and ways to improve the program. The final data set includes: 397 student surveys, 58 student participants in focus groups, 13 teacher surveys, 7 teacher interviews, 187 parent surveys, and 40 parent interviews.

Results

Classroom Observations

SOM©- As indicated in the description of SOM©, the observation procedure focused on 24 instructional strategies using a five-point rubric (0 = not observed, 1 = rarely, 2 = occasionally, 3 = frequently, and 4 = extensively). Two additional items use a three-point scale (1 = low, 2 = moderate, 3 = high) to rate the degree to which academically-focused class time and student attention/interest/engagement are evidenced. In an initial analysis of the SOM© data, rubric categories 2-4 were collapsed into one category to yield a two-category scheme reflecting the percentage of visits in which a strategy was either observed or not observed. As seen in Table 1, the analysis revealed significant differences, which favored Laptop over the Control teachers on project-based learning (65% observed vs. 22%), independent inquiry/research (58% vs. 24%) computer for instructional delivery (22% vs. 0%), and computer as a learning tool (88% vs. 17%). In general, strategies promoting learner activity, such as cooperative learning, inquiry, sustained writing, and computer uses were more likely to be observed in Laptop classrooms.

Table 1: Proportion of times an event was observed (1-4) versus not observed (0)

	Laptop		Control	
Strategies	Observed	Not observed	Observed	Not observed
Direct instruction	68.8	31.3	77.8	22.2
Team teaching	15.6	84.4	11.1	88.9
Cooperative learning	65.6	34.4	38.9	61.1
Individual tutoring	13.3	86.7	11.1	88.9
Ability groups	0.0	100.0	0.0	100.0
Multi-age grouping	0.0	100.0	0.0	100.0
Work centers	3.1	96.9	11.1	88.9
Higher level instructional feedback	61.3	38.7	38.9	61.1
Integration of subject areas	21.9	78.1	5.6	94.4
Project-based learning**	64.5	35.5	22.2	77.8
Use of higher-level questioning	56.3	43.8	50.0	50.0
Teacher as facilitator	71.9	28.1	61.1	38.9
Parent/community involvement	0.0	100.0	5.6	94.4
Independent seatwork	71.9	28.1	55.6	44.4
Hands-on learning	19.4	80.6	16.7	83.3
Systematic individual instruction	0.0	100.0	5.9	94.1
Sustained writing/composition	53.1	46.9	38.9	61.1
Sustained reading	28.1	71.9	38.9	61.1
Independent inquiry/research*	58.1	41.9	23.5	76.5
Student discussion	50.0	50.0	44.4	55.6
Computer for instructional delivery*	21.9	78.1	0.0	100.0
Computer as a tool**	87.5	12.5	16.7	83.3
Performance assessment	37.5	62.5	22.2	77.8
Student self-assessment	18.8	81.3	16.7	83.3

$^{*}p < .05$; $^{**}p < .01$; $^{***}p < .001$

There were seven comparisons that yielded statistically significant differences from *t*-tests comparing the means for Laptop and Control classes on each SOM item, all of which had associated effects sizes of .59 or higher in absolute value (see Table 2). All of the significant differences favored the Laptop classes: computer as a learning tool (*ES* = +2.29), project-based learning (*ES* = +0.95), independent inquiry (*ES* = +0.89), higher-level instructional feedback (*ES* = +0.61), teacher as facilitator (*ES* = +0.64), cooperative learning (*ES* = +0.59), and computer for instructional delivery (*ES* = +0.59).

Table 2: A Summary of Items Showing Significant Differences Between Laptop and Control Group Comparisons on the SOM©*

Items Using Rating Scale A**	Laptop		Control				
	M	*SD*	*M*	*SD*	*t*	*p*	*ES*
Computer used as a tool	2.84	1.43	.16	.38	7.71	.000	2.29
Project-based learning	2.25	1.84	.66	1.32	3.21	.002	0.95
Independent Inquiry	1.90	1.81	.52	1.12	2.83	.007	0.89
Higher-level instructional feedback	1.64	1.53	.77	1.16	2.07	.044	0.61
Teacher as facilitator	2.40	1.70	1.38	1.37	2.17	.035	0.64
Cooperative learning	1.71	1.50	.88	1.18	2.01	.050	0.59
Computer for instructional delivery	.65	1.35	.00	.00	2.04	.047	0.59

*Sorted by Effect Size

**Rating Scale A
0 = Not Observed
1 = Rarely Observed
2 = Occasionally Observed
3 = Frequently Observed
4 = Extensively Observed

SCU- Laptop classes, as would be expected, contained more computers ($p < .001$) than did Control classes. Additional areas where significant differences occurred were that Laptop classes had more: (a) PC's, (b) up-to-date computers, (c) Internet access, (d) printer access, (e) color printer access, (f) computers clustered together, and (g) computers that were distributed. Further, Laptop classes always had at least one student at one computer and rarely had more. By comparison, about half of the Control classes averaged one student per computer, while half had more than five students per computer. All three comparisons involving the availability of computers to students significantly favored the Laptop classes. With regard to student technology skills, Laptop students were rated significantly higher than were Control students on computer skills ($p < .001$), keyboarding skills ($p < .001$), and mouse skills ($p < .01$).

Comparisons of observation means using *t*-tests revealed statistically significant differences, most of which are noted above, and collectively show that Laptop classes provided greater access to computers and associated peripheral equipment to develop higher skill levels by students, to engage students and teachers more extensively in computer applications, to use computers more for research and for production in writing and design, and to make greater use of word-processing and Internet software (see Table 3). Importantly, on the final rubric, Laptop classes were rated as making much more meaningful use of computers compared to Control classes (*M*s = 3.18 vs. 1.00, *ES* = +2.72).

Table 9: Computer Impact

Group		Not Observed	Rarely	Occasionally	Frequently	Extensively
Laptop	Computer (s) worked well***	4.0%	0.0%	0.0%	8.0%	88.0%
	Students were very engaged in computer activities***	8.3%	8.3%	0.0%	20.8%	62.5%
	Teacher provided technical coaching**	18.2%	13.6%	4.5%	13.6%	50.0%
Control	Computer (s) worked well***	83.3%	0.0%	0.0%	8.3%	8.3%
	Students were very engaged in computer activities***	83.3%	0.0%	0.0%	16.7%	0.0%
	Teacher provided technical coaching**	81.8%	0.0%	0.0%	18.2%	0.0%

$^{*}p < .05$, $^{**}p < .001$, $^{***}p < .001$

Writing Performance

Writing Scores. Students in Laptop ($n = 32$) and Control ($n = 32$) classes were asked to write a prompted essay. The essays were then scored in the blind on a rubric encompassing the four dimensions of Organization, Idea, Style, and Conventions. For each dimension, the essay was scored from 1 to 4, with 4 being the highest rating possible.

Mean performance scores for Laptop and Control students were analyzed via a one-way multivariate analysis of variance (MANOVA) with the four dimension scores serving as the dependent variables. The MANOVA yielded a significant program effect ($p = .048$), therefore, univariate analysis of variance (ANOVA) was performed separately on each dimension. All four tests were highly significant and indicative of higher performance by Laptop than Control students. Effect sizes ranged from +0.61 to +0.78, suggesting moderately strong and educationally important effects.

Student Reactions

Student Survey. The Laptop student survey responses ($n = 397$), indicated that students felt their computer skills had increased, and they were better able to do Internet research. They were less certain that using computers at school increased their interest in learning, made them want to get better grades, improved their writing, or made it easier for them to work with other students. Over half of the students reported fairly regular use of the laptop and the Internet for completing homework, while even more reported uses for "other things." The two most frequently cited "other things" were e-mail/chat and games.e-mail.

When students were asked to describe the best thing about having a laptop, students included that it helped them learn computer skills, helped with school assignments, provided access to the Internet, and it helped the students become more organized. When students were asked about the hardest part of having the laptop, there was general consensus that it was difficult to keep track of and carry back and forth to school. Other concerns included reoccurring technical problems (e.g., freezes, charging, slow), using Microsoft Access, and students lacking sufficient computer skills. Overall, the survey results show that Laptop students were highly appreciative of having laptop computers and were taking advantage of its resources for performing a variety of learning activities both at school and at home. Students were more likely to experience benefits of the laptop activities for the development of specific technology skills than for increasing their basic interest in school and grades.

Student Focus Group. The researchers conducted six student focus groups that involved a total of 58 students. Results from the focus groups closely align with findings from the student survey. When looking at learning and performance, the students indicated that they were more involved in writing, researching, and in collaborative project work. Many students reported an improvement in grades, although some students indicated there was no change in grades, and a few said some grades had dropped. Students felt they had a closer relationship with their teachers, more self-confidence, and improved attitudes towards school.

The majority of the students indicated that their parents liked the Laptop program. Others felt the Laptop program had improved relationships between students and their parents, that parents provided more help with homework, and that parents were amazed/happy at how quickly students had gained computer skills. All of the final comments were positive and indicated that the students liked having the laptop and looked forward to using it again next year.

Teacher Reactions

Teacher Survey. Thirteen Laptop teachers responded to the Teacher Survey. Results indicated that teachers were extremely positive regarding the benefits of the Laptop Program for them and their students. All agreed that the program experience: (a) increased their basic skills in computer applications, (b) increased the emphasis on higher-order learning in their classroom, (c) increased project-based learning, and (d) was beneficial to them as teachers. There was also strong agreement that they: were better prepared to create lessons integrating computers, frequently integrated technology, school-related interactions with students and parents increased, and would like to participate in the project again next year.

The teachers indicated that the greatest benefit of the Laptop program was for students to have access to technology and Internet resources. The teachers also felt that use of the laptop had resulted in students having greater research skills, improved writing skills, interest in school, and greater self-confidence. The difficulties cited were all related to the technology itself, e.g., power, weight, drives, server, and printers. They were also concerned with students tampering with software and the laptop settings. As could be expected, teachers indicated that the program could be improved by providing more technical support, more basic training, providing a solution to the power problems and providing more projectors.

Teacher Interviews. There were seven randomly selected Laptop teachers who were interviewed. Teachers indicated that classroom practices had changed due to the laptops in that they used more cooperative learning, completed more projects, and acted as facilitators of learning more frequently. Teachers reported that the projects involved more integration of subjects, research, higher-levels of learning, writing, and the use of spreadsheets, word processing, and the Internet than non-laptop projects. The teachers reported that they use authentic assessment and involve students in self-assessment and the development of rubrics now more frequently. As a result, teachers indicated that students produce higher quality work and had more self-confidence, greater enthusiasm, increased depth of knowledge, and were more engaged with other learners. Teachers indicated that there were fewer missed assignments and an overall improvement in grades.

Parent Reactions

Parent Survey. Encouragingly, parents ($n = 187$) generally viewed the Laptop Program as helpful to their children's education. More than half felt that the program *increased* their child's interest in school, involvement in project-type school work, and research skills. Between one-third to one-half believed that increases occurred in school achievement, writing skills, and ability to work with other students.

Results from the open-ended items show that over one-half of the parents stated that the most beneficial part of the Laptop program was that their child had improved his/her knowledge in different subject areas and also improved in computer literacy. The parents expressed concerns that it was difficult for their child to keep track of, be responsible for, and carry the laptop to and from school. Other concerns were related to monitoring student use of the Internet and overuse of computer games. The parents felt that more training is needed for teachers, parents and students (keyboarding). Another suggestion was to offer the program to all students in the district.

Parent Interview. The parent interviews were conducted with a random selection of 40 parents (20 5th grade, 20 6th grade) whose children were participating in the Laptop study. Overall, the parents were supportive of the Laptop Program and felt that it has had a positive impact on the child's learning and participation in school. There was a general consensus that the Laptop Program was providing their child with important computer, organizational, and research skills that are of benefit now and will enhance their future work opportunities. Most of the parents indicated that the laptop had little influence on the family, however, a few noted positive impacts on younger siblings. The majority of the parents also reported that the laptop had not changed interactions with the child or teacher primarily because they were already actively involved.

Discussion

Results of this study suggest varied impacts of the Laptop Program on students, teachers, and family members. These findings are discussed below in reference to the three primary research questions.

Is Teaching Different in a Laptop Classroom?

According to both teacher reports and classroom observations, Laptop classes are being taught differently than regular (Control) classes. Not only did the former classes incorporate technology to a much greater degree, they tended to employ more student-centered strategies such as project-based learning, independent inquiry/research, teacher as coach/facilitator, and cooperative learning. Most revealing in the study were the ways in which technology was accessed and employed in the Laptop classrooms. Compared to their Control counterparts, the Laptop students demonstrated more technical skill with computers and used computers more extensively for a variety of production and research functions. Not surprisingly, observers rated Laptop classes as making much more *meaningful* usage of computers as educational tools.

Nearly all teachers believed that they were teaching differently than before by integrating technology into both newly developed lessons and existing lessons that had previously been taught without computers. Further, nearly all felt that they had increased the frequency of project-based learning, higher-order learning activity, and school-related interactions with parents and students. Laptop parents reported that their child was taking advantage of the laptop computer for school and other activities, especially in developing research skills.

The implication from these multiple data sources is that teaching and learning were being impacted, in ways that promoted active learning and technology applications, as a consequence of all students having continual access to individual computers. Not surprisingly, although cooperative learning was observed relatively frequently in Laptop classes, students typically worked individually while using computers. Thus, they benefited from having their own computer to complete their work, while still being able to collaborate easily with others on information and strategies.

Do Students Behave Differently in a Laptop Classroom?

As described above, Laptop students were more active, autonomous, and collaborative in their classroom behaviors. For example, cooperative learning was observed "frequently" or "extensively" in 35% of the Laptop classes, but only 11% of the Control classes. Students frequently or extensively engaged in projects in 55% of the Laptop classes compared to only 17% of the Control classes. Laptop teachers confirmed these impressions by describing their students as more independent, active, and engaged. The teachers were highly impressed with students' abilities and interests in using computers to enhance learning.

In their survey and interview responses, students indicated they had increased their computer skills substantially and were much more prepared to do Internet research. About two-thirds of the students generally worked with the laptop alone in the classroom, but they still collaborated frequently with others in sharing information, asking questions, and providing assistance. As a group, the students were less committal about the effects of the laptop in increasing the interest in learning, writing skills, and facilitating collaboration, although about one-third (still a substantial number) felt that they did realize these types of benefits.

Do Students Achieve Differently in a Laptop Classroom?

In this study, we assessed student achievement in terms of writing performance on a prompted essay. Grading, using a four-point rubric, was "blind" to students' enrollment in Laptop vs. Control classes. Results significantly favored the Laptop group on all evaluation dimensions—Organization, Ideas, Style, and Conventions. Aside from being statistically significant, the differences across all dimensions reflected relatively strong advantages for the Laptop group, with effect sizes ranging from +0.61 to +0.78.

Conclusions

In this evaluation of the first year of the Laptop Program, the results are consistently supportive of beneficial impacts on students, teachers, and parents. Specifically, all three groups believed that the program was positively changing teaching and learning both at school and at home. These impressions were directly confirmed in visits to Laptop versus Control classrooms. While more research is needed on how the Laptop Program impacts student achievement, the positive results from the writing assessment are highly suggestive. Laptop students were doing more sustained writing in class and were demonstrating more skill in writing, making a causal connection highly likely. Control classes could also increase their emphasis on writing, but it is obvious that continual and immediate access to computers provided the Laptop students and their teachers with a very strong advantage. In future research, we hope to examine whether Laptop students demonstrate comparable advantages in problem solving. We anticipate that they will, given the extensive project and inquiry activities in which they engage. At this point, given the present data, we are most certain of one program result—Laptop students are much more fluent than other students with using the technology of the 21st Century for learning, research, and production. For them, computers are fully integrated with and a natural part of their educational experiences both at school and at home.

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E-Pals:
Examining a Cross-Cultural Writing/Literature Project

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Introduction

As a middle school teacher in rural North Carolina, I was intrigued by how writing to an authentic audience helped to raise both the motivation and skill levels of my students, many of whom were reluctant writers at best. Students in my class had the opportunity to write often, and to share their writing with their classmates and the greater community. From peer-editing to publishing in our monthly newsletter to performing their writing in front of an invited audience every six weeks, my students simply put forth more effort at attaining polished pieces of writing when they knew it would be seen by others. This concept is not new, as researchers for years have been aware of the effect that an authentic audience, or an audience other than the teacher, motivates students to craft their writing more effectively (Cohen & Riel, 1989; Frank, 1992).

In my classroom, I took the concept of audience one step further by connecting my students with pen-pals back in my home state of Ohio. By conducting exchanges with their geographically distant pen pals, my students' conception of audience expanded beyond their community as they discovered the commonalties and differences they shared with peers 600 miles away. However, unless pen-pal projects are focused around a genuine purpose other than socialization, they can begin to fade. Flower and Hayes (1980) suggest that classroom writing assignments "have a realistic purpose and a real audience (not a teacher), who actually needs to know something" (p. 45). This was the component my students were missing. Also, the time it took to complete an exchange of letters with their distant peers could take anywhere from three to six weeks, as the teacher on the other end of the project would sometimes forget the letters in the trunk of her car as they made their slow journey to the post office. This experience left me wondering how else students could be connected over great distances to discuss topics more germane to the curriculum than their CD collections or favorite movies.

Many recent studies have focused on using networked computers (computers that are connected to one another via the Internet) to connect students to one another to discuss topics relevant to the students' academic program (Eldred, 1991; Fey, 1993; Niday & Campbell, 2000). In a study conducted by Niday and Campbell (2000), middle school students were paired with college students preparing to become English teachers. Using the Internet as their meeting space, the students in both classrooms engaged in discussions about young adult literature. Because e-mail is similar in form to dialogue, it has become a useful tool for extending classroom discussions beyond the four walls of the traditional classroom. In another online correspondence (Citrino & Gentry, 1999), students from Kuwait, Alaska and Utah were joined to share family stories as a way to interpret culture. By allowing students to connect in this way, the stories and experiences they brought to the classroom were validated, and their contributions were seen as meaningful and useful to other students who were trying to learn more about the cultures of their peers.

It was after reading about connections like the ones mentioned previously, and my love of students sharing and discovering themselves and one another through writing, that I was drawn to my study. A local high school literature teacher had been involved with e-mail projects with students from Japan, Australia and Russia for nearly ten years. During the second semester of 1999-2000 school year, I conducted a case study of his classroom during an e-mail exchange with a high school literature class in Moscow, Russia. During this project, the students in both classrooms read short stories by Anton Chekhov and O'Henry. These two authors were chosen by the teachers on the basis of the similar themes present in the stories, as well as the similar time periods in which the authors wrote. By using the stories as a catalyst, the students' goal was to help their distant partner to understand the culture from where the literature came. Below (see Figure 1) is the sequence of the e-mail project I studied. Because the students relied on e-mail as opposed to traditional mail, four exchanges were able to occur, as opposed to possibly one or two. The speed of the exchanges was definitely a motivating factor to the students. However, there were other factors at play in this project as well as the technology. In order to view the project holistically, I examined all of the elements that were at play. I examined the effect that writing for an authentic audience had on the local students, an audience who was learning to speak English, and paying close attention to how the local students used "real" English. I examined the role that large and small group discussions about the literature played on the final written products. Finally, I examined the role that peer editing played both during and after writing had been produced. When examined holistically, it became evident that no single element could be given credit for improving the writing skills of the local students.

Figure 1: Sequence of reading and writing activities for the American students during the e-mail project.

Week	**Reading and Writing Tasks**
1	Students wrote introductory letters to their Russian partners. These letters included autobiographical information plus information about O'Henry. These letters were projected on the wall and peer-edited by the whole class as a group before they were revised and sent to the Russian students.
3	The Russian students' letters arrived. These letters were also introductory in nature and contained information about Chekov. Students began reading the short stories that dealt with the law. These stories included O'Henry's "The Cop and the Anthem" and Chekov's "Chameleon." During the reading process, students asked questions and discussed the text as a class. Students wrote first drafts of their second letters to their Russian partners. These letters were peer-edited in small groups. Revised letters were then sent to their Russian partners.
5	The second set of Russian students' letters arrived. Students began reading O'Henry's "The Gift of the Magi" for the next exchange on Christmas. After reading the story as a class, small groups were formed for brainstorming and writing their responses. After small-group peer editing, the third exchange of letters was sent to their Russian partners.
7	The third set of Russian students' letters arrived. Students began reading O'Henry's "The Last Leaf" and Chekov's "The House With the Mansard" for their final exchange, this time about art. After reading the stories as a class, small groups were formed as before to write and peer-edit their final responses to their Russian partners.
10	The semester came to an end before the Russian students had a chance to complete the fourth exchange of letters.

The E-mail Project

As illustrated in Figure 1, this e-mail project consisted of four exchanges between a local high school literature class and a high school literature class in Moscow, Russia. The American students began the project by writing a letter of introduction to the Russian students. Besides personal introductions, these first letters contained information about the life and work of O'Henry, as the Russian students were involved in a project on American authors. To complete the first exchange, the Russian students chose an American partner and wrote back to them, via e-mail, introducing themselves and including biographical information on Anton Chekhov for the American students to use in their author study. After the initial exchange, the literature guided the online dialogue. The first two stories read were O'Henry's "The Cop and the Anthem" and Chekhov's "Chameleon." Both stories dealt with aspects of the law. Students were to compare and contrast the styles of the two authors, and then relate personal experiences they have had with police or the law. The exchanges continued in this fashion throughout the remainder of the project. Unfortunately, time ran out before the Russian students were able to complete the final exchange. However, enough information had been shared in the three complete exchanges to satisfy the students involved.

The Opportunity to Write for a Distant, Authentic Audience

In order to determine what accommodations students would make when writing to non-native English speakers, I had six focus students write additional letters to in-class peers. Each time a letter was due to be sent to their Russian partners, I asked these students to write an additional letter to another focus group student. By comparing these two letters—one written to their in-class peer and one written to their Russian peer—I was able to determine what the students did differently depending upon their audience. Using the system-wide rubric for holistic scoring as a guide, I compared the two sets of letters based upon their rhetoric/stylistic features such as use of slang, explicitness, and assumed shared cultural context. I also compared the two letters based on usage/mechanical features such as observance of grammatical conventions, punctuation, and spelling (See Figure 2).

Figure 2: Descriptive categories for comparative letters.

Descriptive Categories	Letters to Native Speakers	Letters to Non-Native Speakers
I. Rhetorical/Stylistic Features	1. Use of slang 2. Vague (generalizing) 3. Assumed shared context 4. Informality in register	1. Avoidance of slang 2. Explicitness 3. Lack of assumed shared context 4. Formality in register
II. Usage/Mechanical Features		
A. Grammatical Features	1. Indifference to conventions 2. Use of contractions	1. Observance of conventions 2. Avoidance of contractions
B. Punctuation/Spelling	1. Indifference to punctuation 2. Spelling errors	1. Observance of punctuation 2. Lack of spelling errors

The Opportunity for Discussion About the Literature

Each of the short stories was read aloud as a large group. Student volunteers took turns reading from the text as the teacher sat off to the side, ready to answer questions. As each short story was read, students were encouraged to ask questions and take notes, searching for information that they may want to ask their distant partners about. After the stories were read, students were asked to break into smaller groups of three or four to further discuss what they had read. Before the small groups gathered together, the teacher gave them some guiding questions to think about when composing their letters to their partners. For example, for the second exchange that dealt with the law, he asked his students to focus on the following four topics:

1. Give and incident in which you or a friend had an experience with the police.

2. Give an incident in which a national, well-known case of injustice occurred.

3. Compare and contrast the actions of the police in the two stories.

4. Compare and contrast the writing styles and motivation for writing of Chekhov and O'Henry.

By having his students discuss these guiding questions in small groups, their ideas and experiences could play-off of each other's, resulting in richer letters written to their partner's.

The Opportunity for Peer-Editing

Just as the American students had the opportunity to discuss the literature in groups before they wrote, they had the opportunity to have their writing seen by peers before it was sent to Russia. Recent studies have indicated that allowing students the opportunity to have their work peer-edited before it is seen by a larger audience can be highly motivating, as the students in this project wanted to act as teachers in how to model the correct use of English (Kasper, 2000; Tillyer & Wood, 2000). Peer editing, in combination with the opportunity to discuss the literature in large and small groups, helped the students to take ownership of their writing before it was sent off to their distant peers.

Method

As stated previously, I chose a case study methodology in order to describe this case in its entirety. According to Merriam (1988), "The aim of descriptive research is to examine events or phenomena" (p. 7). For this study, I triangulated my data collection methods. Data collection took the form of pre- and post-project attitudinal surveys, e-mail document analysis, student observation, student and teacher interviews, and a post-project group peer-response session in which I had my six focus students decide how they would take a letter written for one of their in-class peers and change it to make it suitable to send to their Russian partners.

As mentioned above, I used a combination of attitudinal surveys and teacher input to select six focus students with which to work closely during this project. I selected three students who perceived themselves as being strong writers, and three who perceived themselves as being weak writers. This was done to compare what the two groups would do differently when responding to and editing their writing for their distant peers vs. their in-class peers.

Results

Almost every student, both local and Russian, indicated a high level of enjoyment throughout this project. Each of the elements of this project played a key role in the overall improvement of the students' writing skills.

The Opportunity to Write for a Distant, Authentic Audience

After participating in this cross-cultural e-mail project, students indicated that they now paid more attention to their writing based upon their intended audience. The majority of the class (58%) stated in a response to a post-project survey question that writing for an authentic audience (their Russian partners) made them pay closer attention to things like grammar, punctuation, spelling and clarity. Comparing the letters written by the focus students to in-class peers vs. their Russian peers indicates that the usage/mechanical errors and generalizations (mainly due to assuming a shared cultural context) present in the local students' letters to in-class peers were either eliminated or otherwise changed in the letters for their Russian partners. Furthermore, the students indicated an increased sense of confidence and satisfaction with their letters to their Russian partners as the project progressed. In an interview session, one student stated that, "Normally, I don't care how I write. I mean, I'm just writing for myself or for a teacher and it doesn't matter if I can't spell perfectly. But if I'm writing to [my Russian partner], it *has* to be perfect." Similarly, another student claimed, "Most of the time, when I write to a teacher, I just write down whatever and say, 'Here, fix it.' But when I write to somebody else, if somebody else is gonna look at it, I try to make it sound like I'm intelligent and I know what I'm talking about." Because students in this project were writing for authentic audiences and for authentic purposes, greater care was taken in their writing than if they had been writing solely for the teacher (Cohen & Riel, 1989).

The Opportunity for Discussion about the Literature

By allowing students to respond on a personal level to the literature read, the students felt a greater sense of ownership of what they wrote. Plus, sharing their personal responses with peers in both whole and small group discussions gave students more than one viewpoint to consider when composing their own writing (O'Donnell, 1980). This was true for both the strong and the weak focus students. By reading collaboratively, as opposed to individually, all students learned skills that encouraged them to develop "literate behaviors" (Hynds, 1990). Hynds (1990) explains, "Readers develop the will to read through participation in supportive communities of readers. This motivation to read encourages them to seek out and master the necessary competencies and skills" (p. 255). During this project, students were reading for more than simply a grade on a comprehension test, thus their motivation to read and understand was high. The degree to which students connect on a personal level with the literature has much to do with the likelihood that they will continue to read beyond what is assigned to them in class. For this reason alone, providing a collaborative reading community in which to connect to the literature was a benefit.

Each of the six focus students indicated that they appreciated having the opportunity to talk about the literature before they wrote their letters. In fact, the small group discussions seemed to be the most beneficial for the students. Several times I observed students who were not talking very much in their groups, but who were engaged and jotting down ideas as they heard them. Because of their involvement and listening skills, they were able to consider many more ideas for writing than if they had been assigned to write alone without the benefit of prior discussion. Even though quiet students may have made fewer comments, they were exposed to all comments and could draw upon the experiences of their peers to enhance their own writing. As one student stated, "I like talking about what I'm going to write before I write it. I like to know what other people are going to say. That always gives me better ideas." Her comments offer an excellent illustration of Vygotsky's (1978) zone of proximal development. Working alone, this student may not have been able to generate or articulate ideas as well as she could have when allowed to work collaboratively to talk about her writing with her peers.

The Opportunity for Peer-Editing

The opportunities for peer editing was beneficial to each of the students involved in this project. However, the benefits of peer editing were more pronounced for the weaker writers than the stronger writers. Because they did not want to be perceived as "dumb" or "stupid" by other peers, the students identified as weak writers in this project became even more aware of surface-level grammatical and spelling errors than their in-class peers identified as strong writers. According to Tillyer & Wood (2000) this is not uncommon. Many students with weaker writing skills like the pace of e-mail communication—fast enough to keep interest levels high, but slow enough to allow for careful thought and editing before each correspondence is sent (Tillyer & Wood, 2000). With increased confidence and opportunities for genuine purposive writing comes increased motivation to write. As one student in my study stated, "I wish *all* my classes were like [this one]!"

The strong writers in this study also benefited from the peer-editing process. It allowed these students to demonstrate their talents by helping their peers, which increased everyone's confidence (O'Donnell, 1980). Also, by being looked upon as experts, both by their in-class and distant peers, these writers were more motivated to be certain that their writing was clear and error-free, as well as the writing of their peers that they were assisting. The strong writers in this project took their role of expert seriously, as they were in the position to answer not only to their peers, but to their Russian partners as well (Tillyer & Wood, 2000). According to Goussera, (1998) "I believe that electronic discussions [within a collaborative atmosphere] help the students to rely on each other more, and not depend solely on the teacher for answers and comments" (p. 7). With their in-class peers (through peer editing) and their distant partners, (through electronic networking) students involved in this project met one another at multiple sites of interaction, and I feel that their writing was better because of that.

The Role of Technology

According to Tornow (1997), "When a stand alone computer becomes networked, it's as if it suddenly shifts from being opaque to being transparent" (p. 15). In this project, the technology did become transparent. It was a tool that enhanced the curriculum without directing it. However, while using e-mail allowed a timely exchange of letters to occur, and that timelines was a great motivating factor, I still can not be certain that the technology was the most important element in this project. According to the students, the use of technology was at least *as* important (as a motivational tool) as both collaborative discussion and peer editing, but not necessarily more. However, I feel that the technology was a benefit. Because of the increased number of exchanges, students were reading and writing more often (Citrino & Gentry, 1999). The frequency of reading and writing, coupled with the fact that students were working collaboratively to make their own meaning of the text—and sharing that meaning with an authentic audience—all combine to create a project that was beneficial to all students involved.

Implications

Information and knowledge are growing at a far more rapid rate than ever before in the history of humankind. "As Nobel laureate Herbert Simon wisely stated, the meaning of 'knowing' has shifted from being able to remember and repeat information to being able to find and use it" (Bransford, Brown & Cocking, 2000). Bransford et al. (2000) continue:

> More than ever, the sheer magnitude of human knowledge renders its coverage by education an impossibility; rather, the goal of education is better conceived as helping students develop the intellectual tools and learning strategies needed to acquire knowledge that allows people to think productively about history, science and technology, social phenomena, mathematics, and the arts.

Learning how to frame and ask meaningful questions in the attempt to construct meaning about various subject areas is the key to developing lifelong learners (Bransford et al., 2000; Christian, 1997). It is my contention that using networked computers to connect students near and far in collaborative relationships will help to facilitate the development of lifelong learners.

Bransford et al. (2000) suggest that learning for understanding is rare in many school curricula today, as such curricula emphasize memory instead. While facts are indeed important for thinking and problem solving, facts alone, disjointed from their larger contexts, serve as a shaky foundation upon which to build an education. According to researchers (Bransford et al., 2000; Rogoff, 1998), schools and classrooms should be learner-centered, places where the knowledge, skills and attitudes that students bring with them are acknowledged. In my study, students were allowed to display and construct their knowledge collaboratively. The teachers did not have all of the answers, and students were allowed to bring their own knowledge and experiences to light during the process of communicating with their distant partners.

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Web-Based Computer Supported Cooperative Work

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Introduction

Computer-supported cooperative work (CSCW) has been a focus of research and development since the middle 1980s (Greif, 1988; Grudin, 1991), and business and industry have wasted no time in adopting CSCW techniques and technologies (Rein, McCue, & Slein, 1997). Educators, however, have shown less enthusiasm. Although proprietary network-based CSCW (i.e. commercial "groupware") is well established, implementing it usually involves considerable expense and technical expertise. More open (i.e., Web-based) systems are still in early stages of development, however, and do not always provide a sufficiently mature and stable base (Balasubramanian & Bashian, 1998). There are, however, inexpensive and widely available Web-based tools that can be assembled into workable, if not completely integrated, systems that can achieve many of the objectives of complex and expensive CSCW systems.

A CSCW system, by virtue of its collaborative orientation, usually involves a fusion of components designed to address a variety of tasks including preservation and development of organizational knowledge, document management, and computer-mediated communication, all of which are often mediated by a database system. The complexity of systems is brought on, in large part, by the requirement to integrate these systems into a single coherent whole.

Fortunately, higher-level integration is an area where people significantly outperform even the most powerful computing devices. People use tools within complex social frameworks and protocols that can help organize tools and tasks in important ways. Although sophisticated software management systems can help, workable solutions can be achieved with less than optimal technologies if the tasks to be supported are well-understood and effective social protocols are established to compensate for technological deficiencies (Davenport & Prusak, 1998, p. 5; Rein, McCue, & Slein, 1997).

In keeping with this orientation, we began by identifying a loosely organized toolset of familiar office applications and, over a period of approximately 18 months developed an interactive Web site to support project activities as the needs and interests of projects participants became apparent. Specific office applications were employed to establish standard formats for project materials and our Web-based system gradually evolved into our primary channel for both gathering and disseminating project information, support materials, and project-related documentation.

Project Overview

Our project focuses on three major objectives, all related to technology integration in P-12 or post-secondary classroom settings.

1. Assist preservice teachers develop teaching styles that make effective use of technology.
2. Promote preservice teacher use of technology-enhanced learning in their own education.
3. Establish a model for technology integration that can grow and change with technology.

We seek to achieve these objectives with a training and internship program that places digitally literate preservice teacher education students as technology consultants with established public school and university educators interested in learning more about technology integration. This consultant/client model is designed to introduce new teaching and learning technologies in a mutually supportive collaborative environment that benefits the preservice interns, the teachers with whom they work, and the students in the classrooms where technologies are introduced. The project is also intended to develop a broader, more flexible model for technology integration to ease technology transitions for individuals and institutions in a variety of settings.

Well before our first group of technology consultants began their work in the field, we had come to the realization that our success would depend on capturing what we were learning in a well-organized and accessible knowledge base. It was clear that, given our existing workplace practices, documents would be a central element in our knowledge base. Proposals and planning documents had been the foundation for our future work and had helped us establish timelines and assess progress. We also expected to produce a variety of user guides, project reports, and research papers. We were also well aware that managing the flood of paper generated by a large-scale project like ours could be difficult. Distribution of printed documents would create unnecessary and unproductive duplication, requiring participants to manage their own hard-copy document archive, as well as inviting versioning problems that arise when multiple drafts of a document are circulated.

One approach to solving these problems is to create a single centrally managed print document archive, but this approach is usually expensive and relatively inflexible, as a result of the administrative infrastructure that must be created to support intake, registration, and distribution. We opted for an alternative "distributed" approach to document management that allows individual project participants to submit, review, and retrieve documents through our project Web site. The foundation of this distributed approach is a database system that helps us organize materials, while it simultaneously solves problems related to versioning and duplication by providing a single readily accessible but authoritative source. One advantage we had in considering how we might manage the documents produced in our project was the fact that we had immediate control over our Web site, since the project Information Services Coordinator was also the server administrator. It has been our experience, however, that while this degree of control can confer some advantages (e.g., we can rely on our operating system to manage user access), the methods we have developed do not depend on this arrangement. Although working both sides of the traditional IT "divide" has given us an appreciation for the role of technology administration, our decision to emphasize low-tech tools meant we were looking for generic tools that would not require special server access.

Our server platform is a Windows NT machine running Microsoft's Internet Information Server 4.0. One feature of this platform that has been central to our project is its support for Microsoft's Active Server Pages (ASP), an environment for integrating a variety of server-side scripting languages into our Web site, and Microsoft's ActiveX Data Objects (ADO) that support our database connections. Fortunately, however, these technologies provide relatively straightforward methods for creating dynamic database-driven pages without sophisticated programming skills, an important element in making our methods generalizable. Moreover, these techniques can be implemented in a step-by-step incremental fashion that helps those involved in developing and delivering information services acquire skills as they bring new capabilities online.

Overview of the Web-based Systems

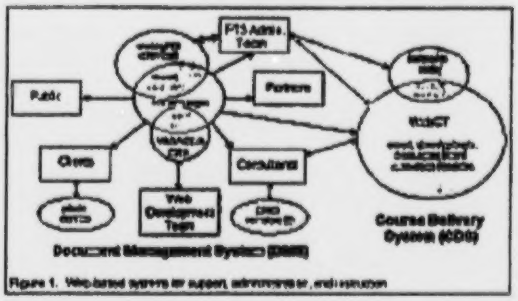

Figure 1. Web-based systems for support, administration, and instruction

As illustrated in Figure 1, our Web-based information system includes two main components, a document management system (DMS) and a course delivery system (CDS). The DMS runs on our project Web site, while the CDS (WebCT) runs on a university server. One disadvantage of assembling project-specific and university resources as we have done is that it requires participants to manage multiple user accounts (for access to different components), but participants have not reported problems managing accounts. Moreover, although these systems are distinct, we have found that information is easily shared since both components are Web-based resources on our local university network. While this arrangement limits our control somewhat, it also means we do not need to manage the CDS, a complex software system. All things considered, we believe our distributed approach has important benefits for both the sustainability and generalizability of our model.

Figure 1 provides an overview of our Web-based systems. Rectangular regions represent users, oval regions represent information, tools, and documents, and arrows represent the flow of information. Some groups are exclusively "consumers" of information, while others also contribute information to the system. Both the Web Development Team and the PT3 Administrative Team, for example, are linked to the DMS with double-headed arrows indicating they receive *and* contribute to this resource. Likewise, both Consultants and the PT3 Administrative Team are linked to the CDS, indicating that these groups participate as both consumers and contributors. In effect, these double-headed arrows represent the interactive elements in our system, places where participants contribute as well as consume information.

The DMS includes five main types of documents. The oval at the top represents documents created and contributed by the PT3 Administrative Team, the group of that leads the project. This part of the system supports operations that are "internal" to the administrative team. Most documents created by this group start out as restricted-access "working" materials, available only to other members of the administrative group. Some of these documents are, however, eventually moved out into the public area. The lowest central oval in the DMS represents a part of the system set aside to support development of support materials. Since members of the Web Development Team have primary responsibility for authoring these materials, this group has authoring privileges and is linked to the system with a bi-directional arrow. As with the administrative materials, support documents are initially held in a restricted-access region but usually move quickly into the public-access region. The final elements in the DMS are private, password protected discussion/bulletin board areas intended to promote and support *private* interaction within the client and consultant groups. As indicated by the arrows, only members of these groups have access to their respective discussion boards.

As indicated on the right side of Figure 1, the course delivery system (CDS) involves two participant groups, consultants and the administrative team. As a part of their project participation, consultants register for a 4-credit consulting course that helps them establish effective working relationships with clients (i.e., participating teachers.) Since our online

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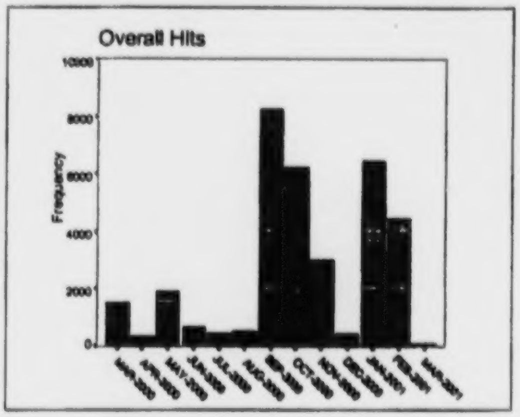
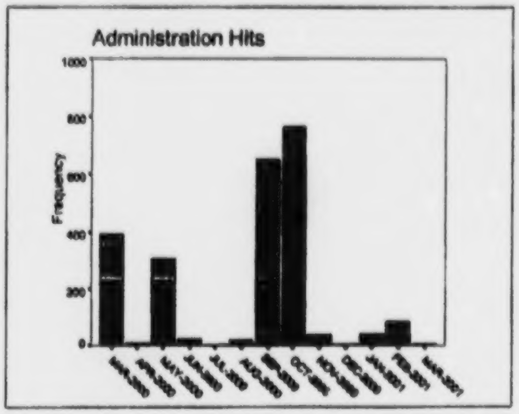
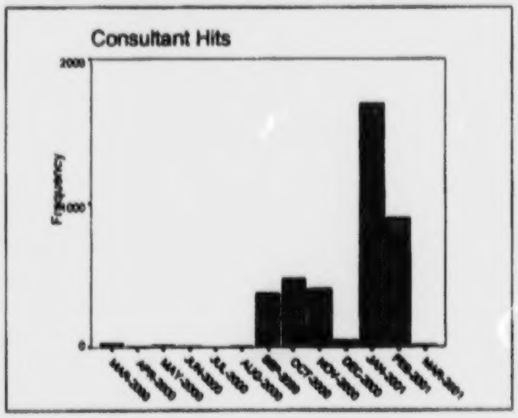
courseware includes a variety of interactive features, both consultants and members of the administrative team who co-teach the course are linked with bi-directional arrows.







Data Collection and Analysis

Analysis of Web server logs revealed more than 34,000 Web site hits from more than 1000 different IP addresses over the 12-month period from March, 2000-March, 2001. There were clearly evident patterns in Web site hits, related to the university schedule. Overall hits in the spring of 2000 were low since the Web site came online in March and only 7 technology consultants were involved. There was, however, a dramatic increase in activity at the start of both the fall and winter terms in the 2000-2001 academic year with activity tapering off toward the end of these semesters.

Hits to administrative pages did not adhere to the more general pattern with larger numbers of hits in the spring of 2000 and no spike in activity at the start of the winter 2001 term as administrative pages were undergoing redesign at this time and were often unavailable. Hits to pages specifically targeting consultants also rose in a predictable fashion during academic terms but did not vary significantly across the months of the fall term of 2000. In the Winter of 2001, however, there was a dramatic rise in consultant hits as a new consultant "Job Board" system came online that allowed consultants and project personnel to track work activity.

Participant Perspectives: Project Director

As project director, my role is leading, coordinating, and making sure that all of the individuals involved have what they need. In order to do this effectively, I need relevant information about all aspects of the project and continuous two-way communication. Because my responsibilities also include teaching our student consultants, I am also in continuous communication with the students. I consider on-demand access to information resources and computer mediated communication essential ingredients in the success of our project. Our Web-based systems make my job much easier.

While our Web resources certainly facilitate the work of the PT3 administrative team, I am most fascinated by observing the use of resources by our student consultants. There is no question that they are personally experiencing the possibilities technology offers in support of learning. Our students have come to consider themselves a community of learners. They build on each other's knowledge through discussion boards and classroom interaction. They often answer each other's questions and provide one another support when challenges arise. They use the technologies at their disposal as just-in-time tools instead of just-in-case last resorts. Perhaps most important of all, they are not learning about technology integration in the abstract, they are actively applying technologies to meet personal learning needs in a way that will transform both their view of the tools and their ideas about teaching and learning. Although it is still too soon to know for sure how their experiences in the project will influence their future professional practices, what we see suggests they will be less likely to limit their future students to a "book learning" model.

Although we are pleased with the tools we have developed, what we have learned about how to more effectively support student learning leads us to conclude that we must continue to expand and develop the communication and information resources we deliver online. Administratively, we have created models that help us manage programs and create, store, and retrieve knowledge more efficiently and effectively. Further, I think we will find that many of our administrative Web resources will evolve into classroom learning support tools—teachers morphing into learning team managers—that's an interesting thought to ponder!

Participant Perspectives: Web Development Team

The primary focus of the Web team is to create support materials for use by consultants and clients. We began by identifying common technology tasks (e.g. how to create a Web page using Netscape Composer) and then created (or linked to) support documentation. For the most part we worked independently. An online "job board" (part of our WebAdmin site—see Figure 1) allowed us to choose a task, keep work records and, ultimately, upload the final version of our completed support material into our "PT3 Problem Solver Database."

In addition to regular Web team meetings, one team member attends meetings with consultants. This provides us an important user perspective on our support system, helping us learn how documents are being used, which documents are the most useful and what, if any, problems are encountered. We are also testing documentation in face-to-face consultant workshops in an on-campus computer lab. Hard copies of documentation are distributed to each consultant at the workshop. Consultants use the documentation as a primary learning resource to acquire new technology skills while Web team members observe their use of the documents. Consultants have an opportunity to raise questions both on a one-to-one basis as they work at a computer or in a group debriefing session immediately following hands-on learning. We have been very pleased with the quality of the feedback consultants have provided us, particularly in our workshop sessions.

Participant Perspectives: Student Consultants (based on interviews)

Overall, student consultants seem very pleased with the resources they are provided. Our discussion boards systems seem to have had the greatest influence in reshaping the way these students think about their learning. The students have begun using phrases such as "community of learners" in describing their experiences. Although one of our two discussion boards is private (the one in the DMS), we know from server stats that they are using this resource. Moreover, based on their comments in interviews, they appear to be differentiating their use according to their perceived role. Discussions that focus on consultants' roles as students appear more commonly on the CDS discussion board, while those that deal with field-based issues related to their roles as consultants appear more likely to crop up on the DMS discussion board.

When asked about whether they felt their PT3 experiences were likely to change their classroom teaching practices, consultants expressed strong opinions that their use of technology will be dramatically different that what it would have been, had they not participated. Consultants indicated they felt they had crossed both a "confidence threshold" and a "competence threshold", in addition to developing practical skills and ideas about integrating technology in classroom settings. It appears that fundamental mental shifts have taken place in the awareness of PT3 consultants concerning teaching, learning, and technology.

Summary and Conclusions

As a result of our Web-based management tools, project participants can interact and share their work with one another through the project Web site. Working groups usually have short weekly face to face meeting to talk over issues but our document management system has helped us automate processes that can be time consuming and error prone. Web Development Team members can select "jobs", track and annotate their work, record hours, and ultimately submit the work they complete (primarily support documentation) directly into the DMS, where it can be accessed by other project participants. A job completed and uploaded becomes immediately available to everyone else, something that seems to reinforce the important idea that the team is developing materials for users, not for their team leader. Our administrative systems have promoted the same sense of immediacy and audience in our project management materials and in the future we expect to initiate a similar consultant management system to help track and support our consultants who are working in the field.

We believe that our success thus far is due in large part to three factors. One factor is our decision to build our knowledge systems around Web technologies. A second factor is our decision to avoid high-tech proprietary systems (i.e. "groupware") in favor of a loose collection of relatively "low tech" tools (e.g., Microsoft Office, email, bulletin boards, and Web-enabled Access databases). And the third (related to the second) is to build on, rather than replace, our existing workplace practices and protocols. We also believe the model we have developed will generalize effectively. It requires only modest tools, modest levels of expertise, and modest changes in the working practices of participants. Once created, the technological and cognitive infrastructures that support the system are easily maintained and can continue to develop incrementally.

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Adapting Online Education to Different Learning Styles

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Key Words: online education, homeschoolers versus traditional, standardized testing

Abstract

The purpose of this research project was to determine if online learning could be adapted to individual learning styles and if that made a difference in the standardized testing scores of Internet students. We then compared those scores to those of traditional students. It has clearly been shown that online learning is adaptive, whereas traditional classrooms are not always adaptable. Our goal was to establish whether online learning and adaptive learning styles made a difference in test scores, and if so, could that knowledge be utilized in the traditional classroom? The answer was yes to both questions.

Current Learning Theories

There is a wealth of information, both on the shelves of libraries on the Internet, which addresses the different learning theories that have been suggested over the past 3 or 4 decades. Those most often quoted are Kolb and Gardner.

While most theorists disagree, or come from a different approach, about learning styles, it is generally accepted that there are basically four stages of learning. They are:

1. *Exposure Stage*—the first time a concept (such as long division) is new to us.
2. *Guided Learning Stage*—when we still can't do the problems without help. This is where most people get stuck.
3. *Independent Stage*- With review, guidance and hard work we reach stage 3.
4. *Mastery Stage*- Comes with more practice, final goal of education

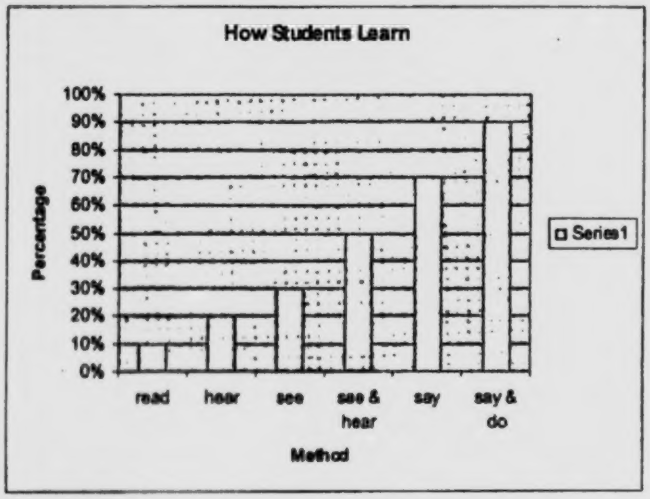
Regardless of how a student learns, the stages remain the same. It is up to the instructor and the curriculum content developer to assist the student in getting past the guided learning stage to become an independent learner, thus building on newly gained learning concepts or skills.

It has also been shown through repeated studies that students learn in different ways, or through a combination of different ways, thus supporting Smith and Kolb's learning cycle concept.

Students learn:

- 10% of what they read
- 20% of what they hear
- 30% of what they see

- 50% of what the see & hear
- 70% of what they say
- 90% of what they say and do



Based on what we have learned, we conclude that students need:

- A variety of teaching strategies
- A variety of learning paths
- Activities which they can read, visualize, hear, say and do
- Instructional guidance leading to independence
- Ability to work on their own with appropriate assessment methods
- Appropriate tools and technology for independent and guided study

Review of Learning Styles

As we have already discussed there is a wealth of information about different learning styles and theories. While many of these theories are methodologies instead of styles it is difficult to relate one to the other, at times. Therefore, we have presented a chart, which shows the relationships a little more clearly, thus appealing to the visual learner!

	Instruction	Testing	Assignments	Reference	Communication
Visual	use of a video clip, diagram, image or map	identification on maps, diagrams, required drawings or sketches, read and response	mind mapping of concepts (webbing) diagramming, construction of PowerPoint Presentations, readings	reference maps, diagrams, pictures, articles	use of electronic white board, electronic conferencing, chat
Auditory	lecture, audio clips	sound identification or verbally administered test	projects with audio components, interviews, seminars, giving of reports and speeches, power point w/ audio component	video or audio clips from a media collection	phone, audio conferencing
Tactile	advance organizer, in class exercises, asking for volunteer participation in class demos or simulations	performance of a task, multiple choice tutorial, reports/papers, portfolio of project work	self assessment quizzes, model building, presentations, demos	virtual field trips	synchronous conferencing, group work
Active	class participation	projects, reports	model building	virtual field trips	meetings
Passive	classtime for reflection or critical thinking	problem solving, essays	problem sets, journaling	observation, reading	webcast
Sequential	outlines, lists, examples	creation or reenactment of steps, processes	creation of steps, processes	reference materials of a procedural nature, scholarly journals	small discussion groups
Global	discussion of concepts, paradigms, theories	essay questions, portfolios	journaling, discussion, relationship construction, mapping	broad based reference materials, news paper articles, magazines and books	large discussion groups

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Sensory	images, sounds, video, demos, simulations	tests that ask for details, tests with accompanying images, audio	creations of demos, images, case studies	virtual field trips	any conferencing tool
Intuitive	case studies, hypothesis, setting and prediction	essays that ask for outcome projections	problem solving, resolution development	readings from various view points, compare and contrast assignments	any type of group work
Inductive	facts, formulas, demos and observations, presentation of background information	problem sets, objective answers, multiple choice	problem sets, memorization, terminologies	sample problems, reference sheets for formulas	any type of group work
Deductive	applications, link of the familiar to the unfamiliar, examples, advance organizers	problem solving applications, scenarios, essays	model building, simulations	case studies	group projects or conferencing

Another part of employing learning strategies and theories is to incorporate Bloom's Taxonomy. Following the 1948 Convention of the American Psychological Association, Benjamin Bloom took the lead in formulating a classification of "the goals of the educational process". Three "domains" of educational activities were identified. The first of these, named the *Cognitive Domain*, involves knowledge and the development of intellectual attitudes and skills. The other domains are the *Affective Domain* and the *Pychomotor Domain*, which we are not concerned with.

Bloom and his co-workers eventually established a hierarchy of educational objectives, which is generally referred to as Bloom's Taxonomy. This taxonomy attempts to divide cognitive objectives into subdivisions ranging from the simplest behavior to the most complex. It is important to realize that the divisions outlined are not absolutes and that other systems or hierarchies have been devised. However, Bloom's taxonomy is the easiest to understand and is widely applied.

When writing curriculum for the online classroom, or even teaching in a traditional environment, it is as important as knowing how a teacher teaches, as well as how a student learns. Only by balancing the two of them can educational goals be realized.

There are several good examples of learning style inventories on the Internet that focus on a variety of learning styles. They are:

1. http://www.uncwil.edu/sasp/online_tutor/learnst.html (Tactile/Kinesthetic, Visual, Auditory)
2. http://www.edu.psc-cfp.gc.ca/tdc/continu/english/invento.htm (Enthusiastic, imaginative, practical or logical)
3. http://diogenes.baylor.edu/Library/LIRT/inventory.html (Visual, Auditory, Tactile)
4. http://alaike.lcc.hawaii.edu/lrc/lstest.html (Visual, Auditory, Kinesthetic)
5. http://www.active-learning-site.com/inventory1.html Vart Inventory (Visual, Aural, Read, Kinesthetic)

6. http://www.mxctc.commnet.edu/clc/survey.htm (Visual, Auditory, Kinesthetic/Tactile

Accepted Online Curriculum Design

Course Format

Until recently online education has been a hodge-podge of techniques in presenting curriculum content and creating an interactive environment. Most of this has been because instructors are attempted to use traditional methods of teaching in the classroom to teach on the Internet. The web based educational environment does well in presenting material in a visual manner. However, as we know, not all learners are visual learners. In order to apply Kolb's learning cycle concept, different methodologies need to be integrated into the learning environment.

Current online curriculum design includes:

- Syllabus
- Course Outline
- Readings or Lectures
- Classroom or Threaded Discussion
- Quizzes/Tests/Assessments
- Feedback and Interaction between student and instructor/facilitator through email

While these elements typically represent a traditional classroom and should certainly be included, courses also need to develop learning activities which address different learning styles and to incorporate teaching and learning strategies into 'each' element so that all learning styles are addressed.

Most of the online curriculum today is presented by universities and colleges who are moving into the online environment. Few K-12 schools, although making use of the many resources on the Internet, actually deliver full-content lessons or courses—via the Internet—to distance learning students.

Because traditional online learning is geared towards the adult learner, it can be assumed that students are aiming for a specific goal (a degree, certificate or grade) and thus adapt their own learning styles to the material delivered. Focus on different learning styles is largely ignored in an attempt to address the largest number of students in order to get a generally acceptable results (a degree, certificate or acceptable grade).

The goal of K-12 education, on the other hand, should be not only to teach basic concepts and material, but also to teach students to maximize their learning style, improve upon other learning styles and develop into a life-long learner who can make the best use of material presented at a later stage in life. In order to do this, K-12 educators have tried for years to incorporate teaching strategies and learning styles in coursework and activities through the use of manipulatives, handouts, visualization aids, videos, films, field trips, etc. When reaching the post-secondary level, many of these teaching concepts go by the wayside in order to accommodate delivering large amount of contents to large amounts of students.

The goal becomes: taking traditional learning style teaching methods employed in the traditional K-12 classroom and applying it to online learning which can then be individualized, not only for the K-12 student, but for adult learners as well.

Four Elements of Online Learning

There are basically four elements of online learning. They are:

1. Instructor/teacher

2. Student

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3. Curriculum

4. Infrastructure or Technology

As mentioned before it is important to know not only how the teacher is used to teaching (so that teaching strategies can be employed and methodologies adapted), student learning styles identified so that they may be addressed, and curriculum formatted in an appropriate delivery style to address all learning and teaching styles, but the infrastructure or technology must support the delivery of the content.

Characteristics of Technology

Technology, typically, is able to do the following:

1. control the mode of delivery and presentation rate.
2. control the order of presentation, pace of instruction and selection of learning activities.
3. monitor learning performance, store responses, and conduct assessments.
4. provide simulations that supply learning experiences in a variety of low-cost and risk-free topics.
5. formulate collaborative learning groups by linking the learner to the instructor and to other students for technical and curricular support.
6. allow access to learning resources and assessment materials via the Internet.

There are currently 10 standard functions of technology in distance education. This is not to say that this is the way that technology 'should' be used, only that this is the way is which it is 'traditionally' employed. Technology is traditionally employed as:

1. the notice board.
2. the public tutorial.
3. the individual project.
4. free flow discussion.
5. the structured seminar.
6. peer counseling.
7. a collective database.
8. group products or projects.
9. community decision-making.
10. inter-community network.

While these functions allow all the elements of the course content to be delivered (syllabus through assessment), the method of delivery and amount of interactivity determines how much of the content and delivery is actually learned and comprehended. Without applying learning styles to the methods in which these technology functions are carried out, technology is not being used to its fullest extend and learners are not receiving the full benefit of online education.

Strengths and Weaknesses of Online Learning

Due to the way in which traditional content has been applied and delivered via the Internet, certain advantages and disadvantages of online learning have become apparent. Advantages include:

- Learning can take place anywhere
- Learning can take place anytime and at any pace.
- There is a synergy between the learner, instructor and environment.
- High quality dialogue can be maintained because it is not restricted by a traditional classroom or time models.
- The environment can be student centered, in that instructors can focus on an individuals learning styles and issues with greater ease.
- There is great access to a larger variety of quality resources.
- There is a level playing field for all learners, regardless of visual or physical handicap, location or learning schedule.
- Teachers can use creative teaching methods in delivering material.

The disadvantages include:

- Equity and accessibility to technology in that not all students can afford top-of-the-line computers with multi-media accessibility.
- Computer literacy—students have different degrees of familiarity with the computer, Internet and software programs. This can adversely impact their ability to participate to the fullest.
- Limitations of technology—there are some things a computer simply cannot do such as real-life simulations, chemical laboratory experiments, and medical dissections. Visualizations are useful, but not as good as actually 'being there.'
- Lack of essential online qualities—without the necessary direction, teaching strategies and integration of student learning strategies, learning styles cannot be fully utilized and learning is limited.
- Levels of synergy—face-to-face or voice-to-voice contact is still useful to establish synergy, trust and mentor effectiveness.
- Some courses (activity, hands-on subjects) can't be taught online—some topics such as music, physical fitness and art are very difficult to teach online.

Learning Activities Which Different Learners Respond Well and Poorly To:

In order to fully take advantage of online learning, an instructor needs to understand what types of activities learners respond to so that they can apply the same techniques in their course delivery. Some of these which they respond well to and poorly are:

Respond well:

- *Activists*—respond well to new problems, being thrown in at the deep end, and team work.
- *Theorists*—interesting concepts, structured situations, and opportunities to question and probe.
- *Pragmatists*—relevance to real problems, immediate chance to try things out, and experts they can emulate.
- *Reflectors*—thinking things through, painstaking research, detached observation

Respond poorly to:

- *Activists* respond poorly to passive learning, solitary work, theory, and precise instructions. They would rather take an active part in learning.
- *Theorists*—the lack of apparent context or purpose, ambiguity and uncertainty, doubts about validity creates a lack of basis for learning.
- *Pragmatists*—Abstract theory, lack of practice or clear guidelines, no obvious benefit from learning do not allow pragmatists to apply learning to real-life situations.
- *Reflectors* —Being forced into the limelight, acting without planning, time pressures creates a tense learning environment.

Adapting Curriculum to Learning Styles

Different Approaches to Distance Learning (Online Education)

Up to recently, there have been two basic approaches to online learning. They are:

1. taking structured, pre-programmed learning materials and creating a "black box" approach where the black box is substitute for the teacher and 'teaches' the student.
2. using the computer's communications functions and creating a "networks" approach which views the computer as a channel of communication between learners and teachers. Teachers teach students and the computers facilitate communications between teachers and students.

While both of these methods may be useful in different circumstances, unless they integrate different approaches to address -different learning styles and create a learning cycle, they are still basically ineffective.

Constructivist Learning Environment

Lately, the most widely talked about theory has been the Constructivist theory that advocates that the learning process should:

1. provide experience with the knowledge construction process (provide students with the knowledge construction process).
2. provide experience in and appreciation for multiple perspectives (multiple ways to think about and solve problems).
3. embed learning in realistic and relevant context (maintain the authentic context of the learning task).
4. encourage ownership and voice in the learning process (student center learning).
5. embed learning in social experience.
6. encourage the use of multiple modes of representation (Use multiple of presentation).
7. encourage self-awareness of the knowledge construction process. (Encourage metacognitive and activities)

Applying the Constructivist Model to the Online Classroom

While the constructivist theory might be an excellent way of looking the needs of the learning process, it does 'not' imply a way to translate those goals into the classroom, and especially into the virtual classroom. That is what we will attempt to do, as well as integrate Kolb's Experiential Learning Model to the online classroom.

The Constructivist Model has four basic principles:

1. Learning is an active and engaged process. Learners should be actively involved in activities that are authentic to the environment in which they would be used.

2. Learning is a process of constructing knowledge.

3. Learners function at a metacognitive level, focusing on thinking skills rather than working on the "right answer." Students should generate their own strategies for defining problems and working out solutions. Students gain wisdom through reflection.

4. Learning involves "social negotiation." Students should be able to challenge their thoughts, beliefs, perceptions and existing knowledge by collaboration with others and assisting their cognitive development process.

There are also some basic assumptions of design in the constructivist model, although theorists have not told us how to apply these to the classroom. They are:

1. All knowledge is constructed and all learning is a process of construction.

2. Many worldviews can be constructed; hence there will be multiple perceptions.

3. Knowledge is context dependent, so learning should occur in contexts to which it is relevant.

4. Learning is mediated (and delivered) by tools and signs.

5. Learning is an inherently social-dialogical activity.

6. Learners are distributed, multi-dimensional participants in a socio-cultural process.

7. Knowing 'how' we know is the ultimate human accomplishment.

The first step to applying the constructivist model to the online classroom is to construct the environment. You can do this by:

1. Take basic information derived from a learning needs assessment and convert it into:

    - learning outcomes.
    - information included in the materials.
    - how material is structured.
    - what the target audience understands about the material.
    - how the material might be structured for the target audience.

2. Review the basic description and link the elements to an appropriate instruction or presentation strategy. I:

    - Identify metaphors.

- The outcome would be a formal description such as a design brief to enable the reader to understand the underlying knowledge structures and the way it is proposed to link them conceptually and intuitively.

3. Review material again with the goal of linking the design ideas into a potential interaction structure.

- Create an interactive mock-up of interactive materials using an authoring tool.

Applying Kolb's Experiential Learning Model to the online classroom:

1. Four processes must be present for learning to occur:

- Concrete experience—laboratories, field work, observations, trigger films,
- Reflective observation—logs, journals, brainstorming.
- Abstract conceptualization—lecture, papers analogies.
- Active experimentation—simulations, case study, homework.

2. Learning is more than just environment:

- It includes active participation in the learning process and "perception of the learning event through concrete experience (sensing and feeling) or abstract conceptualization (thinking and analyzing).

There are also some things that you need to consider in instructional planning:

1. The Learner as a User

- Consider Learning Styles
- The range and extent of user interaction

2. Design Constraints

- Information and Visual Design
- Access—Navigation
- Interactivity and Control
- Motivation

3. Audience analysis—Use appropriate cognitive style instruments to measure and identify the student's cognitive styles

- Kolb's inventory—too laden with jargon and hard to answer
- Myers-Briggs focus on personality rather learning style diminished effectiveness
- Soloman's 28 questions were easy to answer

4. Terminal objectives

- Should focus on students' preferred cognitive styles as well as the nonpreferred cognitive styles.

5. Instructional preparation

- Instructor should match cognitive styles and instructional contents, methods and styles.

Things to consider in the construction of the learning environment:

6. Online contact

   - Construct a supportive environment and provide timely online contact and assistance to all students
     - Online peer contact
     - Online contact between teacher and students

7. Diversified Learning Styles

   - Theory based learning to 'assimilators'
   - Application-based learning to 'accommodators'
   - Individualized learning to 'field independent' students
   - Cooperative learning to 'field dependent' students.

Things to consider in selection of teaching methods:

8. Match the instructional material with cognitive styles

   - Match the type of content with verbal-visual styles
     - Verbal versions of pictorial and diagrammatic material to verbalizers
     - Verbal material to convert to pictorial form and supplied with concrete analogies of abstract ideas to the visualizers

9. Matching the teaching styles with cognitive styles

   - Match the instructional strategy with field dependence-independence style—both cooperative and individualized learning
   - Match the layout of materials with holist-analytic styles—provide holist view and diagrammatic materials such as tables and tree diagrams
   - Match the conceptual structure with holist-analytic style—identify the parts and structure of the material provide a picture of the whole thing
   - Match the choice of presentation mode with sensory preference—written material to verbalizers, pictorial presentation to visualizers and include multiple modes of presentation such as visual, verbal and auditory imagery.
   - Match social preferences with verbal-imagery style—provide lively, outgoing and stimulating presentations to verbalizers and less bothered tasks about a dynamic presentation to imagers.
   - Match teaching aids with hemispheric preference—a combination of various instructional design, teaching techniques, and modes of presentation, such as computer based multimedia presentation, drawings, transparencies, videotapes, lectures and discussions.

When Considering Evaluation Administration:

1. Assessment—should cover the entire course or lesson

   - Contents of the Assessment
     - Knowledge
     - Comprehension
     - Application
     - Analysis
     - Synthesis
     - Evaluation

- Different Assessment Tools
    - Regular assignments
    - Individual or group projects
    - Online or in-class quizzes
    - Take-home exams
- Content of the Assessment Tools
    - Fill in the blank
    - Multiple-choice questions
    - Identification of terms
    - Variety of short answer and essay questions
    - Writing assignments
- In Addition
    - Teachers should provide appropriate hints or
    - Diagrams, tables, and verbal description for different assessment instruments

2. Feedback

- Timely feedback
- Primarily positive and encouraging

The "Ideal" Online Course

In conclusion, if an institution or instructor has incorporated adaptive teaching methodologies and made the best use of the curriculum and technology, an "ideal" online course would include the following:

1. *Full Content Courses*—It should cover the same content that a traditional course would include and should either be text-based, or cover the same content as nationally accepted textbooks such as Prentice Hall, Holt Rinehart and Winston.

2. *Student Learning Objectives which use Bloom's Taxonomy*- Each lesson plan should include student learning objectives which cover the goals and objectives of that particular lesson. They should include Bloom's Taxonomy words at all 6 levels in order to encourage and build upon the learning cycle. They should also include objectives which focus on all the different learning styles; visual, auditory and kinesthetic/tactile.

3. *Teacher Strategies which address all learning styles*—Teacher strategies should be included with each lesson so that teachers have the opportunity and ability to adapt their teaching styles to individual learners without having to resort to continuous re-education.

4. *Activities that adapt to different learning styles*- Web based interactive activities should be included which address a variety of learning styles. These activities should enhance the lesson content and offer opportunity to further exploration in the content area.

5. *Assessments that cover full content*—Assessments that can be computer graded if possible (short answer and essay are rarely graded unless parsing is included in the technology infrastructure) should be included to cover the entire scope of the lesson. They should also be in a variety of forms (identify and define, true/false, multiple choice, multiple answer, short answer, essay) so that individual learning styles are challenged and so that students are encouraged to build a 'learning cycle.' They should also employ all 6 levels of Bloom's taxonomy so that student's are challenged to think on different levels.

7. ***Accreditation by a local or state agency-*** Online courses should be offered by an accredited institution that has undergone a peer review process.

8. ***Curriculum that can adapt to other state curriculum guidelines-*** Course curriculum should be adaptable so that it can include additional learning objectives or activities in order to adapt to differing state curriculum guidelines, if necessary.

9. ***Use of technology to its fullest***—Courses should use technology to its fullest for both asynchronous and synchronous learning, email, and multi-media presentations.

10. ***Be available online 24/7-*** Course content should be available at all times online for student review and access. Students and instructors should also have access to curriculum and technical support, within reason.

Addendum Research Statistics

(All statistics are the result of a 3-year study done by E-Schooll International of Iowa City, Iowa involving a total of 158 students in a 9-12th grade, accredited online curriculum. This was done in conjunction with the Belin & Blank Center for Gifted Education, at the University of Iowa and Intelligent Education, Inc. of Atlanta, Georgia. Standardized test results are taken from the Center for Education Statistics, online database.)

Typical distribution of SAT scores for incoming freshman classes		
700-800	6	2
600-699	29	34
500-599	47	40
400-499	18	24
300-399	0	0
200-299	0	0

Distribution of ACT Scores			
30-36	7	10	12
24-29	48	44	41
20-23	44	40	39
12-17	1	6	8
6-11	0	0	0
0-10	0	0	0

SAT-Verbal	1986-87	1996-97	1997-98
All students	507	505	505
Online Students			538
Homeschoolers	510	512	515
White	524	526	526
Black	428	434	434
Hispanic or Latino	464	466	461
Mexican American	457	451	453
Puerto Rican	436	454	452
Asian American	479	496	498
American Indian	471	478	480
Other	480	512	511

SAT-Mathematical	1986-87	1996-97	1997-98
All students	501	511	512
Online Students			538
Homeschoolers	522	530	535
White	514	526	528
Black	411	423	426
Hispanic or Latino	462	468	466
Mexican American	455	458	460
Puerto Rican	432	447	447
Asian American	541	560	562
American Indian	463	475	483
Other	482	514	514

Average mathematics and science achievement scores of high school seniors

	Mathematics			Science		
	Overall	Male	Female	Overall	Male	Female
International average	500	518	485	500	521	482
Online Students	565	588	545	580	582	558
Homeschoolers	560	590	540	555	579	530
Netherlands	560	585	533	558	582	532
Sweden	562	573	531	559	585	534
Denmark	547	575	523	509	532	490
Switzerland	540	555	522	523	540	500
Iceland	534	558	514	549	572	531
Norway	528	555	501	544	574	513
France	523	544	506	487	508	468
Australia	522	540	510	527	547	413
New Zealand	522	536	507	529	543	515
Canada	519	537	504	532	550	518
Austria	518	545	503	520	554	501
Slovenia	512	535	490	517	541	494
Germany	495	509	480	497	518	478
Hungary	483	485	481	471	484	455
Italy	476	490	464	475	495	458
Russian Federation	471	488	460	481	510	463
Lithuania	469	485	461	461	481	450
Czech Republic	466	488	443	487	512	450
United States	461	466	456	480	492	489
Cyprus	446	454	439	448	459	439
South Africa	356	365	348	349	367	333

Enhancing Elementary Students Creative Problem Solving through Project-based Education

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Key Words: creativity, integration, collaborative learning, project-based curricula, elementary

Abstract

This paper reports on one dimension of a longitudinal study that researched the impact on student creativity of a unique intervention program for elementary students. The intervention was based on the National Profile and Statement (Curriculum Corporation, 1994a, 1994b) for the curriculum area of Technology. The intervention program comprised project-based, collaborative and thematically-integrated curriculum units of work that incorporated all eight Australian Key Learning Areas (KLAs).

A pre-test/post-test control group design investigation (Campbell & Stanley, 1963) was undertaken with 520 students from seven schools and 24 class groups that were randomly divided into three treatment groups. One group (10 classes) formed the control group. Another seven classes received the year-long intervention program, while the remaining seven classes received the intervention, but with the added seamless integration of information and communication technologies (ICTs). The effect of the intervention on the *personal* dimension of student creativity was assessed using the *Creativity Checklist*, an instrument that was developed during the study. The results suggest that the purposeful integration of computer technology with the intervention program positively affects the personal creativity characteristics of students.

Introduction

The curriculum area of Technology is one of eight Australian nationally agreed Key Learning Areas (KLAs), and is primarily concerned with challenging students to *design, make* and *appraise* products and or processes to meet a need and in response to a novel problem. The Curriculum Corporation (1994a) defines Technology as "the purposeful application of knowledge, experience and resources to create products and processes that meet human needs" (p. 3). Technology could therefore be perceived to be an intellectually creative problem-solving process that is applied in a range of culturally valued domains. Thus, curriculum programs dealing with Technology should be linked to the accumulated psychological research on intelligence and intellectual development, and the closely related research dealing with creativity and problem solving, in order to provide the programs with a sound theoretical basis.

Intelligence, as used in this study, is defined as a unique set of abilities or proclivities, the possession of which affords the individual the ability to solve problems, or to create novel products, valuable in the specific cultural setting in which they are created. Intelligence is thus viewed as a pluralistic cognitive construct (Biggs & Moore, 1993; Gardner, 1983). Further, an individual's creative processes and products could be perceived as the *mirror* through which to view the upper limits of intellectual ability in specific domains.

Creativity, giftedness, prodigiousness, expertise and even genius are terms that are repeatedly and often inconsistently used throughout the literature pertaining to intelligence and intellectual development. Gardner (1993a) proposes a general framework and definitions for these terms in what he calls the "giftedness matrix" (p. 50). Creative is a term Gardner states, that is generally reserved for those individuals who fashion products that are initially seen to be novel within a domain, but which are ultimately recognized as acceptable and even valued within a specific culture.

Early research by Getzels and Jackson (1962) and Wallach and Kogan (1965) contrasted highly intelligent versus highly creative students, and found that while the two traits are not the same, there is good evidence that creativity and intelligence are related. More recent research by Davis and Rimm (1998) found that a base level of intelligence is essential for creative productivity, but above a threshold (about IQ=120), there is virtually no relationship between measured intelligence and creativity. This result is supported in the literature by numerous other researchers, among them MacKinnon (1978), and Walberg and Herbig (1991). Walberg and Herbig noted that the brightest students are not necessarily the best at creativity, and that higher levels of intelligence are less important to creativity than are other psychological traits. Thus, general intelligence as measured by IQ tests, does not necessarily dictate who will and who will not be creative. Further, true creativity, of the sort which has been defined here, and which is generally most culturally valued, namely the ability to solve novel problems or fashion unique products in a specific domain, could not be measured accurately with traditional pen-and-paper intelligence tests.

The Intervention

The Technology KLA curriculum documents refer to the use of an interactive problem-solving process to create complex products in response to open-ended instructions (Curriculum Corporation, 1994a, 1994b). An intervention program, comprising four school-term length project-based, thematically integrated units of work, was developed based on these documents. The intervention was designed as a unique method of implementing the national curriculum in elementary classrooms. The four units of the intervention were entitled: Toys-by-Us, Medieval Europe, Settlement and Colonisation and, Multiculturalism in Australia.

Each unit was a fully integrated curriculum unit of work that utilised the skills, processes and understandings specific to the Technology learning area in order to enhance outcomes for students across all curriculum areas. For example, the Toys-by-Us unit challenged students to design and make a new toy that a particular age group would like, as well as design and make the packaging for the toy, and create an advertising campaign to help market the toy, including an appropriate advertising poster, magazine advertisement, television or radio jingle (See handouts).

Thus, each of the four units challenged students to use the complex and highly personal processes of analysis, synthesis and reflection, in their efforts to create a domain-specific product. It is proposed, that through involvement in such Technology units, students will develop their creative problem-solving skills and processes, which will then be transferable to all curriculum areas (Gagné & Smith, cited in Brown, 1987; Kuhn, 1986; Nickerson, 1989).

A similar creative problem-solving process was followed in all four units. In addition to the basic cyclical Technology problem-solving process comprising the four stages of investigating, designing, making and evaluating (IDME), each unit also contained teachers notes and curriculum links to the other seven key learning areas. Each project ran for approximately 6-8 weeks. Teachers attended two, two-hour professional development sessions at the start and half way through each term or unit, in order to reflect, plan and share their experiences and expertise.

The design task for each unit required the students to work as a member of a four-person production team. Each production team was assembled based on Gardner's (1983) theory of multiple intelligences. Each team contained at least one student who was strong in each of the seven primary intelligences outlined by Gardner. Thus, within each team, there was *at least one* person who was able to perform any task that the project required. Therefore each team was well placed to be able to fulfil successfully all parts of the complex, multi-faceted design task.

The Intervention Plus Computers

It would seem plausible to assert from the accumulated literature pertaining to computers in education that student learning outcomes should be enhanced by the curriculum integration of computer technologies. According to Hamza and Alhalabi (1999) a teacher's primary role is to educate students to think, to learn and to make creative connections that they previously might not have made. They believe that computers can assist students to creatively bridge prior and new knowledge by (1) facilitating the establishment and maintenance of communities of learners; (2) providing a safe environment in which creative behaviour and risk taking is valued; (3) providing students with divergent imagery, including mindmapping tools; (4) providing students with cognitive tools with which to learn critically and creatively; and (5) providing students with multiple means of organising, representing and presenting information. Jonassen (1996), and Jonassen, Carr and Yueh (1998) also believe that the computer's divergent imagery and mindmapping tools can be productively used in classrooms to enhance critical thinking and creativity. They emphasise the use of computing tools for semantic organization, dynamic modelling, information interpretation and knowledge construction.

There is also extensive support in the literature for the idea that computer-mediated communities of learners can facilitate the development of higher order thinking, problem solving and creativity (DeCorte, et al., 1999; Karre, 1994; Scardamalia & Bereiter, 1995). Certainly, computers provide students with multiple means of organising, representing and presenting information. For example, some mathematics educators such as Kaput (1992), and Lesh and Doerr (1998) have argued that hypermedia systems offer a radical new range of representational opportunities that have the potential to provide students with greater opportunities for creating mathematical knowledge. Further, many studies have found that providing access to multimedia authoring software can enable students to explore and produce highly creative ways of organising and presenting information to different audiences (Parker, 1999; Riley & Brown, 1998).

Thus, the computer, as the second industrial revolution (Simon, 1987), has the potential to increase the power of the intellect, just as the invention of the steam engine amplified and boosted the physical power of humans. Schools have a well-documented history of using technologies such as pencils, paper, books, an abacus or calculator to support or extend the power of the intellect. The personal computer is a recent classroom addition to this range of technological tools (Rowe, 1993). But it is not enough to view the computer simply as an intelligence amplifier. Computer tools not only amplify individual capabilities, they also serve to dramatically alter cognitive tasks. Computers both increase the speed and efficiency of our mental efforts, and they also alter the problem-solving tasks themselves and, in so doing, they alter the cognitive processes we use to solve problems (Proctor & Burnett, 1996). Therefore, the computer should be seen as not only having the potential to amplify human mental capabilities, but also of providing a catalyst for intellectual development.

Purpose of the Study

This study assessed the impact of the intervention program described above on the creativity of three groups of students. One group experienced only the intervention program, without specific reference to classroom computer tools, while a second group was actively encouraged to use their available classroom computing resources to support their creative endeavours within the intervention program. The third group comprised a non-intervention control group.

While the curriculum units were identical for the two intervention groups, the intervention group labelled Program+Computers (P+C) specifically integrated computing tools with the curriculum units, while the Program Only (PO) intervention group did not use computers to facilitate their creative problem-solving. The hypothesis underpinning the specific integration of classroom computing tools into the intervention program is that when computer technology is seamlessly integrated into the curriculum program, especially a program such as this which encourages creativity, the computer technology will become a medium of expression for students, a catalyst for intellectual development, and will support excellence in teaching and learning and in thinking about and with computers (Proctor, 1999).

In particular, this paper will address the following specific research question from the overall study: Is there a difference among the three groups (P+C, PO and Control) when their *personal* creativity characteristics are compared at pre- and post-tests?

Method

Subjects

The subjects involved in this study were 346 year 6 and 174 year 7 students comprising 24 class groups from seven state elementary schools in Brisbane, Australia. The students had a mean age of 10.7 years and 54% were male. Fourteen of the classes from five of the schools were allocated to either of the two intervention groups that were named Program+Computers (P+C) and Program Only (PO). Each of these groups contained seven classes. The other 10 classes in the two remaining schools acted as a non-intervention control group that was named No Program (NP). All seven schools were co-educational, outer-suburban schools with a mixture of socioeconomic groupings ranging from low to moderately high and a heterogeneous mixture of academic ability levels. A total of 520 students were involved in the study and complete data sets were obtained for 438 of these students.

Their teachers grouped students into production teams of between four and six students. The amount of class time spent on each unit averaged 3.5 hours per week for the 14 classes involved in the PO and P+C intervention groups.

The four stages of the Technology process used in each of the units—investigate, design, make and evaluate (IDME) are represented in Figure 1.

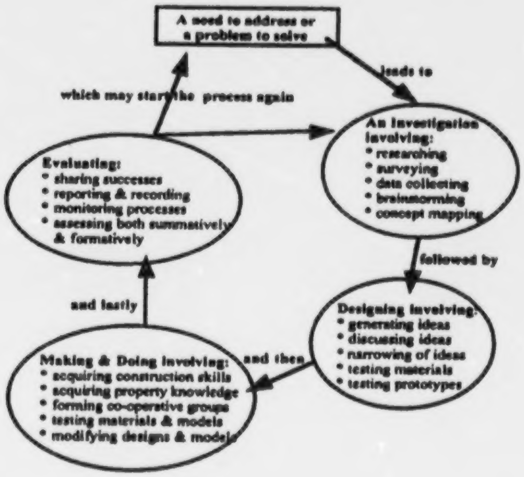
A need to address or a problem to solve
leads to
An investigation involving:
* researching
* surveying
* data collecting
* brainstorming
* concept mapping
followed by
Designing involving:
* generating ideas
* discussing ideas
* narrowing of ideas
* testing materials
* testing prototypes
and then
Making & Doing involving:
* acquiring construction skills
* acquiring property knowledge
* forming co-operative groups
* testing materials & models
* modifying designs & models
and lastly
Evaluating:
* sharing successes
* reporting & recording
* monitoring processes
* assessing both summatively & formatively
which may start the process again

Figure 1. A diagrammatical representation of the four stages in the cyclical Technology IDME process.

Measurement Instrument and Procedures

The personal dimension of student creativity was assessed using the *Creativity Checklist* at the pre-test in February and again at the post-test in December. Class teachers completed the checklist based upon observations of their individual students, made in the classroom context during the course of the study. The Creativity Checklist was designed to rate each student's personal creativity traits on a three-point nominal scale (Rarely, Sometimes, and Often) with regard to nine traits that are considered in the literature to be most commonly used for real-world, goal-directed creativity, namely: fluency, flexibility, originality, elaboration, intrinsic motivation, curiosity or task immersion, risk taking, imagination or intuition, and task complexity or challenge. This approach of profiling an individual's abilities, such as creativity, was recommended by Gardner (1983) and recognizes that an individual's creative proclivity can only be assessed from within a domain (Technology projects) and in light of the judgments of a knowledgeable field of experts (teachers).

Therefore, the primary purpose of the Creativity Checklist was to provide teachers with a simplified observation instrument with which to rate each student's real-world, goal-directed creativity, as it is demonstrated in the classroom setting. Each of the nine items contains several performance indicators to assist teachers to rate elementary students on each item. Also, the meaning of the items was explained to teachers at a professional development session that aimed at reducing the potentially high inferential and subjective nature of the instrument. The scale's reliability and construct validity were assessed from the pre-test data. A factor analysis revealed a single factor solution with an eigenvalue greater than one and accounting for 63.7% of the variance. All nine items of the factor loaded at .68 or greater. It was concluded that the Creativity Checklist has high internal consistency and is a reliable measurement instrument of the theorized construct.

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Results

The data were analysed using the Statistical Package for the Social Sciences (SPSS) for Windows (Norusis, Release 10.0.5). A repeated measures ANOVA was used to compare the means of the three treatment groups across time. The analysis indicated a statistically significant group-by-time interaction effect ($F(2,435)=3.54$, $p=.03$) and the pair-wise comparisons using dependent t tests ($p<.01$) were significant for the P+C group only. Table 1 displays the means, standard deviations and significant post hoc results for each of the three treatment groups.

	Mean (Standard Deviation)		
	NP(n=168)	PO(n=124)	P+C(n=146)
Pre-test	2.03(0.56)	2.11(0.51)	2.09(0.55) *
Post-test	2.03(0.62)	2.11(0.53)	2.22(0.53) *

Note. NP = No Program Control Group; PO = Program Only Group; P+C = Program + Computers Group. * $p<.01$.

Table 1: A Comparison of Means (with Standard Deviations) Among the Three Treatment Groups for the Creativity Checklist (N = 438)

Figure 2 plots the pre- and post-test means of the three groups. The results indicate that the teachers of the P+C treatment group perceived their students to have enhanced their personal creativity characteristics over time relative to the other two groups.

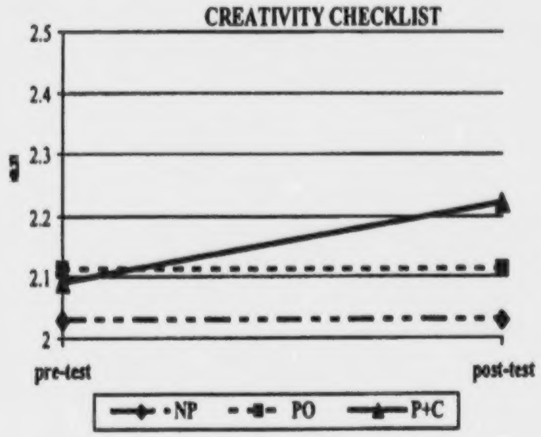

Figure 2: The pre- and post-test means of the three treatment groups for the Creativity Checklist.

Discussion

When the Creativity Checklist data were analysed, a significant group-by-time interaction was achieved, and this appears to have been accounted for by the P+C students displaying significantly more positive personal creativity characteristics at the post-test, than they did at the pre-test. The results indicated that there was not a significant difference among the groups at either testing time. However, the P+C group did show a statistically significant increase in their mean from pre- to post-test. Interestingly, the PO and NP groups' means stayed exactly the same for the duration of the study. These results suggest that the purposeful integration of classroom computer technologies with the Technology intervention program, positively affected the teachers' perceptions of their students' personal creativity characteristics. The intervention alone was not sufficient to enhance the teachers' perceptions of their students' creativity. Why was this?

The basic premise upon which computer technology was integrated into the intervention was that it would become a medium of expression for the students and would support excellence in teaching and learning. The integration of ICTs provided the P+C students with multiple means of organising, representing and presenting information to their various audiences in creative ways (Parker, 1999; Riley & Brown, 1998). The computing tools offered the P+C students a new range of representational opportunities that provided them with greater opportunities for creating and for demonstrating their creativity (Kaput, 1992; Lesh & Doerr, 1998). This enhanced visibility of the students' creativity was possibly what the P+C teachers were responding to, hence the improvement in the P+C group over time.

However, Rowe (1993) suggested that technological tools such as computers not only amplify cognitive capabilities, they also alter the basic fabric of the tasks themselves. Therefore, the computer not only has the potential to amplify existing human mental capabilities, but also to provide a catalyst for intellectual development. Hamza and Alhalabri (1999), and Jonassen (1996) believed that computer *mindtools* could enhance creativity. The P+C students exhibited enhanced creativity. Thus, the result could also be attributed to the integration of ICTs with the intervention, which provided a catalyst for the group's intellectual development. The integration of the classroom computers with the P+C intervention provided the cultural means of empowering cognition, and more specifically creativity.

In the P+C intervention, the computers were intertwined not only with the way in which students might go about tasks, but with the whole context of learning and teaching; and, as a result, the students' personal creativity was enhanced. Due to recent infrastructure projects by the Queensland state education department, all 24 classrooms involved in the study had access to a similar quantity and quality of hardware and software. Therefore, it is not merely the hardware or software available in a classroom that will determine the extent of the computer's input into education, but rather what teachers and students *do* with those computing tools. Rowe (1993) asserts:

> In reality, computers in the classroom are far more than a treatment ... The introduction of computers changes the classroom culture. A fundamental feature of any attempt to evaluate the impact of this technology must thus be a focus on the dynamic interplay between learning processes, students, teachers and the learning context. (pp. 14-15)

These results suggest that, in order to capitalise on the computer as a cognitive tool in the classroom, its integration must also be accompanied by an increased understanding of the teaching and learning processes and their impact on cognitive development.

With economic and political importance being placed on using computers in elementary schools, it is fitting to question the value in terms of cognitive development for students, that is derived from this infusion of computers into the curriculum. What effect will these computers have on our students, teachers, schools, and communities? How do we best implement curriculum initiatives in order to optimise the educational benefits for each individual student?

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Effective Teaching Styles and Instructional Design for Online Learning Environments

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Abstract

Internet-based, distance learning solutions are finding increased use, and may prove effective in facilitating advanced study coursework for remotely located, place-bound students. Despite the current emphasis on distance learning, the conditions for promoting online learning success have not been entirely defined. We present a case study that profiles the teaching challenges and benefits of an online graduate-level Instructional Design course for in-service teachers taught through Western Governors University and Washington State University. This work addresses some of the teaching challenges for this online instructional experience, focusing specifically on how teaching styles were used to build online learning community, to effectively promote productive and satisfying learning interactions, and develop student problem-solving and critical thinking abilities. Also discussed are those instructional design strategies that were repeatedly employed in multiple course sections to increase online student engagement, critical thinking, and enhance student learning. The findings of this study should prove of interest to anyone currently developing or delivering online instruction.

Introduction

Online Learning Environments

Computer-mediated instructional environments, or online learning environments (OLEs), are networked learning tools that are finding increased use in institutions of higher education. Online learning environments provide an interaction space that allows students to actively engage in critical dialogue and reflect on information in a way that facilitates knowledge construction and higher order thinking (Jonassen, Carr, & Yueh, 1998). Effectively designed OLEs also provide a communal workspace for group and peer-based teaching and learning (Collis, Andernach, & van Diepen, 1996) whereby student metacognitive awareness and critical understanding can be developed (Hannafin, Hill, & Land, 1997). Online learning environments are seeing increased use in institutions of higher education that are feeling pressure for delivering educational materials to a wider student audience. Many colleges and universities are investing considerable time and money in distance delivery methods to meet the diverse needs of learners; yet in spite of the effort and resources being spent, we do not have a comprehensive understanding of what factors influence successful student learning in online domains (Brahler, N.S., & Johnson, 1999).

Online learning environments are thought to provide a venue for developing higher order thinking skills in college students (Ewing, Dowling, & Coutts, 1999; Jonassen, 1995a), and are widely assumed to have a positive impact on student higher order thinking and learning. However, opinions differ greatly on how to effectively implement online technologies into learning (Ewing et al., 1999). Technology does not of itself cause the development of advanced cognitive abilities (Jonassen, 1995a); rather, a major determinant of higher order thinking skills development is the quality of discourse that occurs within well designed, properly structured OLEs (Oliver, Omari, & Herrington, 1998). Ideally, OLEs possess several characteristics: a means of accessing, generating, and sharing information; support learner articulation of knowledge and reflection on what they have learned; represent and simulate authentic, real-world problems and contexts; provide structure for student thinking; support critical discourse among learners within a learning community (Jonassen, 1995b); promote student control of learning decisions; and integrate multiple learning perspectives (Jonassen, 1993). In reality, the promise of OLEs is largely unrealized, as many instructors use online learning environments as simple knowledge repositories (Jacobson & Spiro, 1993). When properly structured and utilized to their potential, OLEs are capable of moving education from teacher-centered, lecture-based, passive instruction to learner-centered, self-reflective, active learning (Lan, 1999). Considerable research has touted the purported benefits of OLEs (Collis & Smith, 1997; Goldberg & McKhann, 2000; Koschmann, 1994), but little work has been done specifically dealing with how instructional design and styles of teaching influence student higher order thinking in these environments.

Teaching Styles, Instructional Design, and Online Learning

Teaching styles, hypothetical constructs used to characterize the teacher-student interaction (Fischer & Fischer, 1979), are based on several criteria. An instructor's beliefs regarding teaching and learning, how these beliefs are translated into teaching practice within a learning environment (Fereshteh, 1996; Grasha, 1994), how instructors present information, interact with students, manage and supervise learning tasks, and mentor students (Fereshteh, 1996; Grasha, 1994) are all components of teaching style. Instructors' teaching styles vary considerably; unfortunately, not all variations effectively promote student learning. The question remains: which styles of teaching most effectively develop student higher order thinking skills in OLEs? Many instructors are under the impression that the same teaching styles and approaches used in their traditional classes will also work in an online classroom (Diaz & Cartnal, 2000). While it is unclear whether traditional classroom teaching styles can translate to online domains, instructors utilizing facilitative, guidance-based, interactive teaching styles more effectively create critical thinking opportunities for the majority of students (Kember & Gow, 1994). Students report greater learning satisfaction with facilitative styles of teaching as compared to traditional authoritative instruction (Friday, 1990). Concurrently, facilitative teaching approaches that promote problem solving and critical thinking can be uncomfortable for students, and may be in contrast to students' superficial approaches to learning (Andrews, 1996). Collectively, these findings indicate that teachers that use facilitative, problem solving-based instructional approaches provide thinking challenges despite student discomfort with critical thinking.

Instructional design also plays a significant role in online learning success (Winfield, Mealy, & Scheibel, 1998). While technology can enable learning opportunities, it is teachers' careful planning and incorporation of instructional strategies that contribute to student interaction, growth, and learning (Kirby, 1999). In particular, instructional designs that incorporate student-centered learning approaches in online learning environments support student reasoning, problem solving, and higher order thinking (Land & Hannafin, 1997). Furthermore, the instructor's questioning skills significantly affect student critical thinking outcomes in college courses (Bonnstetter, 1988; Elder & Paul, 1997). By using systematic questioning techniques (Hannel & Hannel, 1998) and/or research-based questioning methods (Adams, 1993) in their teaching style and instructional design, teachers can enhance critical thinking skills in student learners (Adams,

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1993; Hannel & Hannel, 1998). In addition to questioning techniques, the quality of the college student learning experience (i.e. critical thinking) is partially determined through other, less tangible, instructional design components like planned social interactions, alternative, non-lecture teaching formats, student learning choices that exploit personal interests and strengths, teaching approaches that provide real-world contexts for learning, and course material demonstrating the value of diverse cultures and perspectives (Stage, Muller, Kinzie, & Simmons, 1998).

The Study

The present case study focused on the quality of student learning as a function of teaching style in an online learning environment hosted by Western Governors University and Washington State University. Student participants, a collection of technology professionals for their respective K-12 school districts, were enrolled in a graduate level "Instructional Design and Performance Improvement" course as part of the Masters in Technology and Learning degree at Western Governors University. For this content area, class size was strictly limited to 20 or fewer students, based on recent suggested benchmarks for Internet-based distance education (*Quality on the Line: Benchmarks for Success in Internet-based Distance Education*, 2000).

The Instructional Design and Performance Improvement course was comprised of an informational Web site (http://education.wsu.edu/TL/522/) and the primary communicative tool for the course, an email listserv. The course Web site contained an outline of course requirements, student evaluation criteria and grading procedures, required and recommended texts, and instructions for completing the primary assignments for the course, three problem-based Instructional Design projects. In addition, several descriptive hints for project development were included. The three projects comprised the majority of the course grade (90%) with the remaining 10% for student participation in weekly online discussions. Also included on the course Web site were email hyperlinks for direct student access to the course instructors and coordinator, as well as instructions for subscribing to the email listserv. Students were assigned readings from the required textbooks, and the instructor posed weekly questions to the listserv so that all class members could potentially participate in any aspect of any posted discussion. Questions were structured and goal-oriented but open ended, and were designed to develop student research and evaluation skills that were necessary to successfully complete each of the three projects. An email listserv format was chosen as the discussion tool as it was anticipated that all students had ready access to email technology. Hardware and software requirements for full email functionality were minimal; using more sophisticated communication systems could have limited remote student access potentially. Students were required to post at least one well-developed, thoughtful answer to each weekly question as a criterion for student course performance.

The course design specifically emphasized problem-based learning by requiring students to develop three in-depth research projects that were distinct but built upon one another. The first project invited each student to evaluate and assess their specific, unique instructional environment by constructing a well-developed instructional technology assessment rubric, and to preliminarily identify a pressing instructional problem particular to their environment. The second project requested that each student describe in further detail his or her specific instructional problem, and provide supporting rationale with relevant literature. The primary goal of the second project was to research and develop a proof-of-concept model for pilot testing a potential solution to the identified instructional need, and to determine the instructional effectiveness of the proposed solution via educational testing. Finally, the third project bid each student to critically reflect how their instructional practice has changed, what aspects or models of the instructional design process were most useful to them, and how they planned to implement their solution in future instruction.

Methods

Research Question and Variables

In an attempt to identify and comprehend some of the important criteria for learning online success, our research questions were: Does teaching style affect the quality of student learning and satisfaction in online courses? and 2) What impact does course design play in online learning success? For this study, our first independent variable was the instructor's teaching styles, which represented 1) instructional design content expertise; 2) provided learning structure and guidance; 3) provided a personal example for learning and instructional leadership; 4) guided, questioned, and facilitated student interaction, active learning, and critical thinking; and 5) cultivated student learning abilities so as to empower student learners to become independent, functional Instructional Designers. Our second independent variable was the course instructional design, which reflected the structure and purpose of inherent course activities. Our dependent variable was the overall quality of student learning in the online domain. Indicators of student learning quality included the frequency of interaction, the quality of weekly teacher-student and student-student discourse, the level of student writing confidence and development of content expertise, and the degree of reflection and revision indicated in student responses.

Learner Demographics

For the studied sample of online students, 33% and 67% of the class were male and female respectively. Students average age was 35, with a range from 26-46 years. Sixty-three percent of the online students used PC-format computers, 25% used Apple Macintosh, and 12% used some other format. Online students had a wide range of technology proficiency and experience; 38% considered themselves experts with word processing and sending and receiving email, 19% searching for information via the WORLD WIDE WEB, and 6% creating and editing a Web page. Many of the online students were first time graduate students, with little to no research experience.

Learning Quality Assessment

The categories of the teaching styles independent variable were determined using a validated Teaching Styles Inventory (Grasha, 1996), whereas the student learning quality dependent variable was evaluated qualitatively (Guba & Lincoln, 1982) via weekly and semester observation. In addition, students evaluated various aspects of the course, the instructor, and their learning experience with a 140-item, validated survey questionnaire (Silhouette Flashlight). Specifically, the Flashlight survey asked students: 1) the degree to which course assignments were stimulating, challenging, and encouraged student creativity; how quickly students received feedback, and how effective the reflection and revision process was; 2) the instructor's teaching effectiveness with regards to the teacher's ability to build students' confidence and promote student learning success; 3) how authentic the context and relevance to working environment was; 4) whether the instructor provided an informative, thorough evaluation of student thinking process and course performance specifically highlighting strong points and points for improvement; 5) the degree to which the instructor provided yes or no answers; 6) how well the instructor bolstered student learning confidence and stimulated excitement about course material and productive student interaction; and 7) whether students would recommend this general type of distance course, this particular course, and the course instructor to others. The survey also assessed student comfort with the course, specifically focusing on 1): student satisfaction with assignments; aspects of community building; 2) the level of thought put into responses; 3) whether students were likely to spend time on issues not related to course; 4) whether students were more likely to try and search for their own answers before approaching the instructor; 5) if they were better able to visualize course concepts; and 6) the effectiveness of the course structure and design.

Results

The results of the Teaching Styles Inventory (Table 1), which was used to characterize the course instructor's instructional approach, and an online interaction profile for the Instructional Design and Performance Improvement course is displayed below. In addition, qualitative survey assessments that measured student perception of online learning effectiveness and course satisfaction are portrayed, as are examples of student course evaluation.

Table 1: Instructor Teaching Styles profile

	Teaching Styles Inventory				
	Expert	Formal Authority	Personal Model	Facilitator	Delegator
TSI Score	4.2	4.2	5.3	6.6	5.1
Standard Score	-0.27	-1.08	0.13	1.83	1.67

Table 2: Instructor Interaction with Online Students over the Course Term

Term	Total Responses	Instructor Responses	Instructor / Total Responses
Spring 2000	916	229	25%
Summer 2000	904	345	38%

Students were asked to complete a survey regarding their perception of various aspects of the online learning experience, specifically focusing on how effective they perceived the online learning to be, and how satisfied they were with specific components of the online discourse. The survey used a variety of Likert-type assessment scales in addition to fill in the blank and open-ended questions. Seventy-five percent of students enrolled in the course participated in the survey. Of the students that responded to the survey, the majority strongly perceived the course instructor to give highest priority to building students' confidence in their ability to learn difficult subject matter, was concerned with the academic success and assisting all course participants to learn, provided detailed, useful comments on assignments within a short time (24 hours), and in general encouraged meaningful communication between the instructor and the students. In addition, students perceived the course instructor to be genuinely interested in what they had to say, and knew something about the instructor as a person, not just an instructor. With regards to course content, the majority of students strongly felt that course activities and assignments were stimulating, had authentic, real-world contexts and effectively promoted learning, and that the online course experience helped them to manage large, complex tasks, work through a process to solve problems, and exercise their creativity. Student respondents also reported that they looked forward to working on assignments for this online course, and that student development from the online learning experience would have direct relevance to and impact on their professional lives.

A collection of student quotes regarding the effectiveness of online instruction and utility of the online learning experience are included:

> "Given the fact that the facilitation was online and we never talked face to face, I feel it covered all the needed areas and provided the feedback and information needed as well. Answers to questions were prompt and to the point. You gave useful feedback and insight into the instructional design field."

> "Overall this course has been a very good experience. I have learned a great deal. Thank-you for letting me make this course relevant to my day job. Being able to do that has been invaluable."
>
> "This was my first experience with a listproc, and it was very helpful to be able to read all the comments and submitted assignments. The weekly assignments did a great job guiding us into the different projects. I now feel I have a very good understanding of the instructional design process. The personal and professional growth attained through participating in this class has made me a better professional educator."
>
> "I did appreciate your comments, and took them to heart whether it was on a weekly question, or as part of evaluating my projects. Your sense of humor kept things in proportion, but still deadlines were deadlines, etc. I always want to know where the line is and with your reminders, there was never a doubt."
>
> "[I] wanted to say that although I didn't think that operating through a listserv was the best way to take this class, I've changed my mind over the last month and a half... this class has been straight forward and I think that the listserv has actually drawn us into the class more effectively than using Web boards."

Discussion and Conclusions

Online learning, for better or worse, appears to be a trend that will continue for some time as educational institutions look for innovative ways to provide a quality learning experience for their students (Brahler et al., 1999). This qualitative case study provides some insight into the distance learning process, and identifies some factors that may partially determine learning success for students in online domains.

The results of this study suggest that specific teaching styles can be used to promote effective student learning in online learning environments. In this distance learning experience, Facilitator and Delegator teaching styles were used extensively by the instructor, and were characterized by such activities as problem-based project development, guided student exploration, online group discussion, self-discovery exercises, learning debates, case studies and independent, student-designed research, and using the instructor as an independent resource (Grasha, 1994). In addition, the Personal Model style was used by the instructor to illustrate alternatives, demonstrate ways of thinking, outline the thought processes involved in research-based project development, and to share personal viewpoints (Grasha, 1994). Finally, both Expert and Formal Authority teaching styles were used to provide a modicum of content expertise; however, the primary instructional goal for this online course was to begin with graduate students with little or no research or instructional design experience, and guide them on a path of self-discovery to a point of autonomy and independence within the Instructional Design field. Accomplishing this goal meant that students needed to develop their own content to a large extent. Collectively this meant that the instructor had to nurture student confidence and guide student development of independent research and individual critical thinking skills; thus the high scores for Facilitator and Delegator teaching styles. In this case, Expert and Formal Authority styles were utilized to provide structure within the independent learning environment, and to emphasize the high learning and performance standards set for the students.

For the graduate Instructional Design and Performance Improvement course offered through Western Governors University and Washington State University, we found that interplay between the teacher's and students' personalities was essential to productive learning. These findings were consistent with previous research that states teachers' personalities must be built into online courses (Winfield et al., 1998). Initially, it was essential that the WGU instructor establish a level of trust, professional credibility, and community with the students. Since the students were unable to 'see' any physical expressions of the instructor, it was vital that the teacher's initial responses were confident and competent, and that students felt part of a larger community of learners. As teacher confidence and competence was conveyed, the students expressed more trust and confidence in learning from a teacher in an online context, and shared more personal information in initial community building exercises as a result. When one has a class of 20 students, small, collaborative subgroups may spontaneously form. This phenomenon was also observed in the online classroom. Much research has shown the benefits of small group collaborative learning in online environments (Collis et al., 1996; Hiltz, 1998; Newman, Johnson, Webb, & Cochrane, 1997); however, in this context, small online groups served the purpose of community cohesion rather than collaborative learning.

Despite the high demand for this course, the course coordinator strictly limited the number of students to 20, a number that ensured a reasonable teacher/student ratio and was consistent with professional recommendations (*Quality on the Line: Benchmarks for Success in Internet-based Distance Education*, 2000). In addition, it was important that student learning become the focus of the course, not the teacher. In this case, the simple technologies used for this course and the design of the instruction allowed the technology to blend into the background and become more transparent; as a result, the students spent more time engaged in rigorous discourse and developing research abilities and critical thinking skills. In this scenario, the technology was a convenient, effective means to an end, not an end unto itself.

Several interesting trends were observed over the course term for this online teaching and learning experience. One intriguing observation was how student perception of other's work led to increased performance expectations. In traditional face-to-face classrooms, student work is generally not publicly displayed, and the instructor is many times limited to teaching to students with the worst performance to try and increase average class performance. In the online classroom, students were encouraged to submit works in progress to the listserv as project development proceeded. This had the unexpected effect of increasing average class performance, presumably because less motivated students were exposed to high-quality projects and were prompted to increase their efforts by class overachievers. In this case, the instructor was not limited to teaching to the lowest performing students; instead students tried to emulate the project quality of the best students. It is unclear whether this shift in student perception would have occurred in a traditional classroom. A second, inadvertent discovery was how consistent the number of total responses was for two successive course terms was, differing by only 1% between the first and second times the online course was offered. The implications of this are not totally clear, but it appears that it may be possible to predict the number of responses that will be generated in any online, listserv-managed course based on number of students participating, course duration and teaching style.

The Instructional Design and Performance Improvement course relied on an email listserv. This asynchronous method of communication allowed students to contemplate their submitted comments prior to submitting them for perusal by their class peers and the course instructor. Face-to-face interactions, such as those that occur in a traditional classroom, tend to be more spontaneous and unstructured. As a result of the asynchronous method, student responses in the online classroom tended to be more structured and well thought out.

In conclusion, we maintain it is the quality of human interaction that determines online learning success. We conclude that online instructors can use teaching styles to achieve instructional goals and provide rich, satisfying learning experiences for online students. The results of this study are intriguing; however, this study is not without limitations, and the conclusions drawn by the authors are speculative and preliminary. Only a small sample was used for this qualitative investigation, and as such there are limitations to how far these findings can be generalized. Additional studies in this area are necessary to more definitively support these conclusions.

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Teaching and Learning With Information and Communication Technology: Success Through a Whole School Approach

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Key Words: teaching and learning with ICT, whole-school implementation, student learning outcomes, a model for real success

This paper reports on research carried out through a case study which sought to identify how institutionalized teaching and learning practices and processes—'the way we do things around here'—led to successful teaching and learning with information and communication technology (ICT) at a large contributing New Zealand primary school (700 students aged 5 to 11 years). The research findings were considered against the backdrop of the international literature, historical trends, and current educational conditions for New Zealand schools in relation to ICT.

The research established three important questions which must be asked (and answered) if successful school-wide implementation of teaching and learning with ICT is to be achieved: *Why* does the school believe it should teach and learn with ICT? *What* student learning with ICT is proposed to occur? *How* can the processes and practices of teaching and learning with ICT be put into place?

The research questions were designed to uncover the elements of teaching and learning with ICT at the case study school (Central School). However, these questions led on to others concerning funding for, and research into, teaching and learning with ICT in schools. A major contention of this research is that Government funding for ICT in schools should be linked to demonstrable improvements in student learning outcomes. The research also contends that immediate adoption of 'practised and proven' approaches already existent in some schools would help many other schools improve teaching and learning with ICT in their respective learning communities.

Why Teach and Learn With ICT?

Schools need to be clear about the reasons they are teaching and learning with ICT. There needs to be a philosophical base, a rationale, underlying their decisions and approach. Most importantly, schools must ask what they are trying to achieve with, for and by their students in regard to ICT learning. Any one or a combination of the rationales developed by Pelgrum and Plomp (1993), and summarized by Brown (1997): vocational, economic, commercial, marketing-related, cost-effectiveness-related, social, 'transformational', and pedagogical may appeal to schools, or they may develop their own rationales. But the key question must always be: "Are the interests of our students being served?"

Central School built its approach to teaching and learning with ICT on a set of agreed aims and objectives for students and developed its rationale for teaching and learning with ICT by consulting with staff, parents and students. The school then legitimized the intentions of the learning community within the school's charter. Thus, a foundation was laid on which the learning community of Central School had clearly established its shared purpose and set its expectations regarding ICT teaching and learning, and the provision of ICT-related experiences and opportunities for all students.

What to Teach and Learn with ICT?

In the absence of any set ICT curriculum and with the aid of only recently established, non-specific national directions (Ministry of Education, 1999), New Zealand schools have been left to either reinvent what others are doing successfully or simply drift along. A major contention of the research relating to this peper is that schools must take responsibility for teaching and learning with ICT. Therefore, schools must be clear about what they expect their students to achieve with ICT, so that at some point the school can answer the following questions: Where its students were? Where they are now? Where are they going?

Central School committed itself to a pedagogical approach that sought to create, establish and build ICT learning outcomes with and for students. As a result, a very clear set of learning outcomes with ICT has been established for its students. Furthermore, if staff members are to be competent and confident with ICT, they must also be familiar with what is expected of students. Professional development at Central School focuses primarily on developing this familiarity, while also extending staff skill and knowledge to enable further application of ICT with students. The research also highlighted the ICT teaching and learning documentation developed by Central School and it reports, through the participants in this process, on the implementation of the intentions outlined in these documents. The research revealed a resounding concurrence between parents, staff and students as to what they are doing collectively with ICT.

It was considered important that the school's ICT teaching and learning rationale, as well as its ICT practices and processes, continued to be the focus of ongoing sharing of experiences and ideas amongst staff. A number of means through which this sharing and discussion of ideas at Central School were identified included: new staff induction processes; in-school staff development; staff sharing and discussion at staff meetings; and the 'buddy teacher' process. The greatest strength noted within Central School's ICT culture is the collective consideration, agreement, review and renewal by staff of the school's ICT teaching and learning rationale, practices and processes.

How to Teach and Learn With ICT?

Schools that have agreed on *why* to do something and have established the thrust of *what* to do should then be in a position to consider *how* to go about the process of actually doing it.

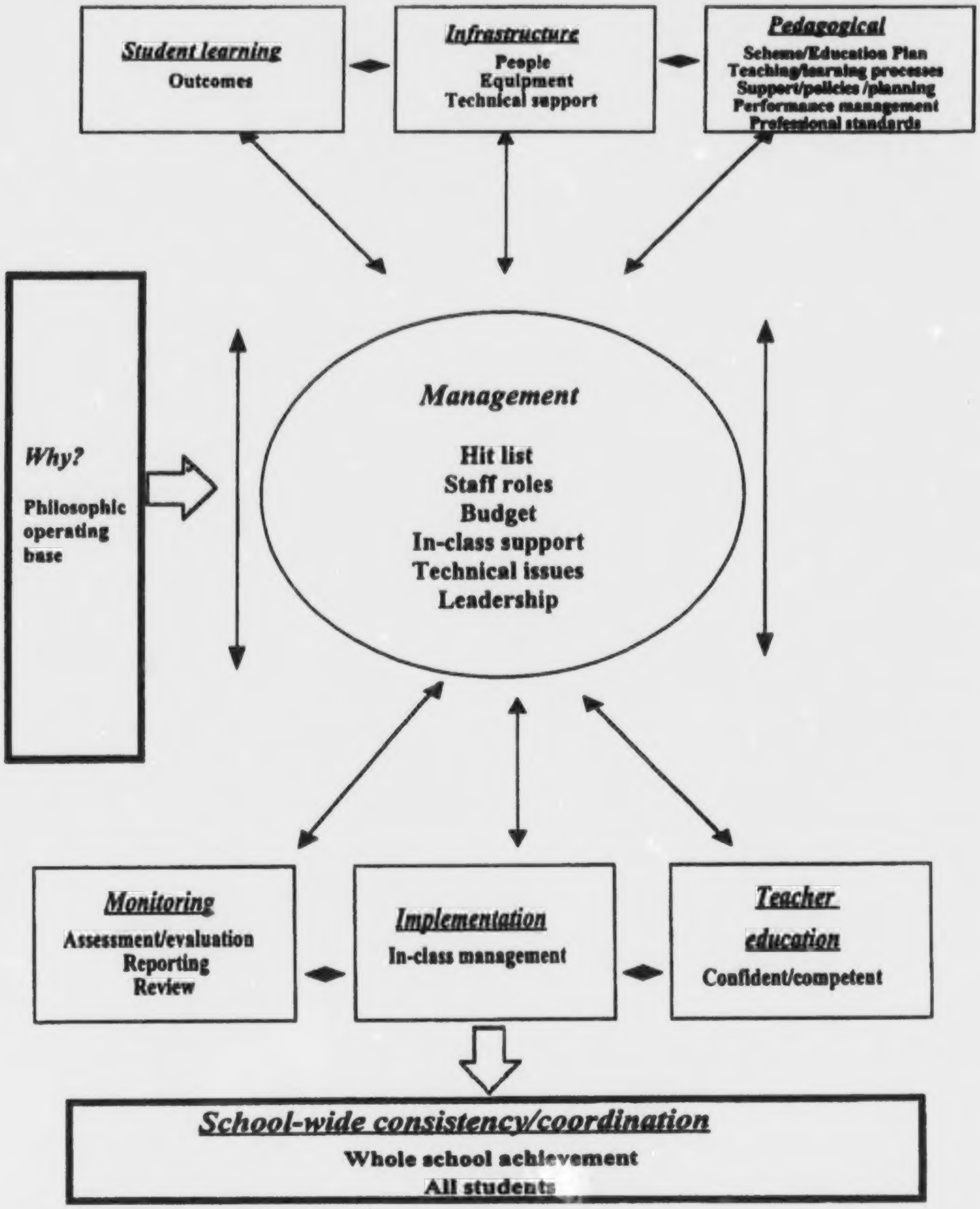
This situation is not unlike preparing for and going on a journey. There is agreement on a destination and the reasons for the journey to be taken. There is a need to map out the route in advance. There is the process of looking for signposts that should confirm, for all concerned, that they are headed in the right direction and will ultimately arrive at their destination.

As a learning community, Central School identified a destination with an agreed reason for wishing to arrive at that destination. Most importantly, perhaps, the school *documented* these elements of their journey with ICT. It also constructed an explicit set of signposts in the form of graduated learning outcomes. These elements have all been translated into the parameters within which teachers must manage teaching and learning processes with ICT and provide learning opportunities and experiences for their students.

Central School may not have the best answer for its students, but it has an answer that is working. The school continues to openly presents the *why, what* and *how* elements of its processes and practice with ICT to others.

A Model for School-Wide Implementation of ICT

The following Figure 1 presents an overview of the ICT teaching and learning in application model operating at Central School. The model identifies all the elements that support and build the successful implementation of school-wide achievement in teaching and learning with ICT.



Student learning
Outcomes
Infrastructure
People
Equipment
Technical support
Pedagogical
Scheme/Education Plan
Teaching/learning processes
Support/policies /planning
Performance management
Professional standards
Why?
Philosophic operating base
Management
Hit list
Staff roles
Budget
In-class support
Technical issues
Leadership
Monitoring
Assessment/evaluation
Reporting
Review
Implementation
In-class management
Teacher education
Confident/competent
School-wide consistency/coordination
Whole school achievement
All students

Figure 1: Model of inter-related elements for school-wide implementation of teaching and learning with ICT.

Student Learning The research shows that student learning is a key outcome with ICT. Indeed, the approach to teaching and learning with ICT at Central School is built on and around student learning. All planning and action considers the interests of the students. While this may seem alarmingly obvious to most teachers, the primary emphasis of ICT in many New Zealand schools, and indeed the historical focus of the Ministry of Education, has been on teacher professional development.

By concentrating on student learning outcomes, Central School has been able to establish agreed signposts for its 'ICT travelers' as they go about their journeys of discovery. By setting out its intentions for students, Central School has been able to delineate a set of skills to be acquired and a series of applications that allow students to demonstrate their skills in a meaningful context. The school has also specified its intention to develop learners who can process information and learn independently through ICT modalities. Thus, learning with ICT is not considered to be an end in itself. Rather, it is considered to be a means of fostering meaningful communication, creativity, design and problem solving.

Infrastructure The research identified a continued emphasis by New Zealand and international schools on access to equipment as the most important determinant of implementation of teaching and learning with ICT. There is no question that, in the absence of hardware equipment, little can be achieved with ICT. However, the amount of equipment the school has is not the primary determinant of success.

The concept of 'human infrastructure', however, is of greatest importance to Central School. While equipment helps facilitate the processes of learning, *people* make all of the processes work. Whatever the level of equipment infrastructure, any school-wide implementation of teaching and learning with ICT is unlikely to succeed without the 'human infrastructure' in place and working.

Technical support is another important issue. Too many breakdowns in equipment guarantee an eventual breakdown in teacher patience and enthusiasm. When the complexity of possible problems with computers is added to the wide range and number of users, there is no doubt that technical problems will occur. For the past three years, Central School has invested in a technical solutions programme that has cut down the 'fix it' time, such that it is very unusual that equipment needs to be taken off site, and even more importantly prevented many previously 'regular' breakdowns from occurring at all. Furthermore, and as a result of using this programme, the school has been able to reduce its total maintenance budget and free up teaching staff who were previously required to give up their time trying to fix problems about which they had limited knowledge. Even worse, these teachers would often inadvertently exacerbate the problem. The need for schools to ensure ongoing and effective technical support must be built into any ICT budgeting process.

Pedagogical In keeping with the student-focused approach at Central School, clear emphasis has been placed on attending to pedagogical issues. Having an agreed, documented, consistent school-wide approach to teaching and learning with ICT ensures that staff are clear about what to do. However, while the specific purpose and outcomes for students are clearly documented, there is also scope for variation so that staff can make the journey fun, as well as challenging and meaningful.

Central School has made the teaching and learning with ICT a compulsory part of what it offers all students. This is seen by parents and staff to be a significant factor in ensuring school-wide and consistent implementation of ICT. Essentially, the school has assumed responsibility for this in the absence of any Government directive. Central School has shown that it is not prepared to leave teaching and learning with ICT to chance, and has accorded ICT the importance of other learning areas already made compulsory by the Government through National Curriculum statements (Ministry of Education, 1994 and 1995).

Central School has singled out ICT as a specific area for teaching and learning as opposed to taking the view that ICT should be integrated. There is clear evidence in school documentation and from staff 'voices' that ICT is used across the curriculum and can therefore be considered to be integrated. Indeed, Central School treats ICT in a similar fashion to reading. Both learning areas can be considered as tools for learning across the curriculum. Yet at a primary or elementary school level, the teaching and learning of reading is considered a subject in its own right, in which students are expected to master a series of skills to be put into a series of meaningful applications. Students are encouraged to process information, to create, enjoy and design as they go about making sense of their world through reading. The learning community of Central School has decided that ICT must be afforded similar importance to reading and applied in practice within similar operating parameters.

Leaving teaching and learning with ICT to chance, or suggesting that ICT be simply integrated into what schools are already doing, often consigns any aspirations for school-wide implementation of ICT teaching and learning to the scrapheap. The focus for schools must be pedagogical, not technological.

***Monitoring*-** All schools that aim for student achievement with ICT should extend their monitoring practices to cover student ICT learning outcomes. Moreover, parents and the wider school community have a right to know how any ICT funds have been used and the extent to which successful achievement of ICT learning outcomes with their children has resulted from the use of these funds. The research clearly indicated that Central School could present and validate such data through its monitoring processes.

***Implementation*-** One of the most difficult tasks for teachers is managing teaching and learning with ICT in their classrooms. Teachers at Central School are able to learn quickly from others, to discover what works for them and what does not. They can look at processes and practices in place in other classes. They can present and share ideas in small and large groups. They have access to in-class support for problem solving and development. They have 'buddy teachers' to work with, access to an active ICT team, and are part of a staff whose members are all involved in the pursuit of similarly agreed goals and objectives. They have a computer in class, shared computer work stations between three classes and a computer suite for whole class teaching and learning all bound together through a base of agreed student learning outcomes and facilitated through a vibrant and dynamic school intranet. It is a whole school approach that brings about and complements the daily reality of teaching and learning with ICT for all teachers, that is, managing learning with their students in their classroom and beyond the school.

***Teacher Education*-** While professional development is an important element in the process of implementing teaching and learning with ICT, such development should be in response to *why* schools are teaching and learning with ICT, *what* the schools are intent on achieving with and by students, and *how* the management of ICT processes and practices could occur.

Central School presents a wide variety of professional development options, both in terms of content and approach, to its staff. The content focuses on what is expected to take place with students. Part of this content focus requires staff to master the learning outcomes of the student 'certificate programme content'. Examples of professional development include: one-off sessions for large and small groups, usually out of classroom teaching time; individual tutorials from ICT team members; 'just in time' assistance, (that is, at the time the need occurs) from an ICT 'buddy teacher'; and in-class coaching from the ICT coordinator. Staff consider in-class coaching and the time made available through the school for the coordinator to carry out her role and responsibilities to be major contributors to the successes enjoyed with ICT at Central School.

The successful implementation of teaching and learning with ICT at Central School is once again a result of the focus on students by the people charged with making teaching and learning with

ICT work. Shared responsibility of professional development for, with and by teachers at Central School is a key.

Management All elements of the model presented in the figure are interrelated. The elements all serve the needs of the students at Central School, and removal of any one of these would result in an end to the successes the school enjoys with ICT. The elements are complementary; they contribute collectively to the continued development and improvement of learning with ICT for and by students.

The processes of management with ICT at Central School provide the 'oil and glue' for the operation. Managing the process involves oiling the elements such that movement continues to take place throughout the school. Management must also provide the glue that ensures the elements hold together in a relationship that allows complementary development to take place.

Central School has an ICT (management) team charged with a range of responsibilities for ensuring that the 'oil and glue' operates in practice. The team attends to planning issues, budgeting, equipment distribution, maintenance, professional development and documentation. Its role is often reactive and 'hands on'. However, another major part of the ICT management team's role is to inform, advise and lead. To this end, the team is proactive, looking to future developments for the school through the provision of professional development, equipment and new ideas. The team's leadership role requires it considers immediate and medium term issues as well possible distant changes on the horizon. The team also serves as an agent of change within the school. Importantly, the ICT team is comprised of practising classroom teachers and administrative staff members with a range of experience with ICT. Team members are able to test ideas and often represent the best means within the school of effecting change because they understand both ICT and the real world of the classroom.

The case study research demonstrated that Central School utilises a range of ICT teaching and learning elements and management skills, all founded on an agreed operating base, to bring about identifiable school-wide achievement with ICT for all its students.

Implications of the Research

Schools

The major aim of the research presented in this paper was to identify key elements of the case study school that are responsible for the successful implementation of teaching and learning with ICT in that school. It is contended that those elements that contribute to successful implementation of ICT in the case study school may be applicable, with similar outcomes, to other schools. To this end, the researcher has identified a number of points which schools should address when considering the future implementation of teaching and learning with ICT at their schools. These are as follows:

Why	Establish agreed reasons in the learning community as to why the school is teaching and learning with ICT.
What	Develop a range of learning outcomes for student achievement with ICT.
How	Provide clear management guidance relating to the implementation of practices and processes that support the provision of ICT learning opportunities and experiences.
Responsibility	Take responsibility for students' learning with ICT, rather than wait for external requirements to be handed down.
Compulsion	Make ICT a compulsory learning area.

Leadership	Provide leadership at the top and encourage leadership in all participants.
Management	Maintain both the flexibility ('oil') and inter-relatedness ('glue') of the complementary elements of teaching and learning with ICT.
Change	Expect, be aware of, and manage the daunting but very necessary processes of change with, for and by people.
Expectations	Agree upon and set high expectations for all - especially the students - involved in teaching and learning with ICT.
Staff Confidence	Recognize the importance of staff confidence and competence with ICT for bringing about change and coping with the stresses change will undoubtedly present.
Teacher Education	Ensure professional development for staff is school-based and designed to help the school implement its processes/achieve its goals for students.
Student Awareness	Ensure that students are aware of what the school wants them to achieve, both in the immediate and long term.
Independence	Aim for students to become independent learners with ICT who are aware of the learning process and have the skills to apply it.
Documentation	Initiate, develop and review documentation that outlines and supports the agreed school-wide processes associated with teaching and learning with ICT.
Infrastructure	Be aware that ICT 'human infrastructure' is more important than equipment infrastructure.
Technical Support	Ensure that technical support is part of ICT processes and practices.
Monitor/Report	Plan, assess, evaluate and report on student achievement with ICT to parents and your school's governing authority.
Review	Establish tools for reviewing current processes in order to guide future development.
Communicate	Keep all members of the learning community informed about developments and regularly revisit the agreed elements of the plan.
Costs	Be aware of the human, financial and time costs; this will help ensure that the huge investment into ICT can and will pay off for students.
Whole School	Ensure sure that *all* students and staff are learning with ICT.

As major stakeholders in the processes of teaching and learning, principals and governing authorities must take responsibility for ensuring that their learning community is moving in a considered manner towards the successful implementation of teaching and learning with ICT. Principals must coordinate all people in the learning community and inspire them to achieve success with ICT by their students. They must have the desire to bring about the necessary changes and be prepared to take bold, albeit measured action when appropriate. They also must win the confidence of their staff by giving staff members the responsibility to take ownership of the change process. There will undoubtedly be difficulties and casualties along the way. However, if students' needs are kept at the forefront, and an agreed rationale for action is in place, principals will find that bringing about changes in teaching and learning with ICT can be achieved.

Governing authorities should consider their role in relation to teaching and learning with ICT. Generally, they are responsible for the development and approval of policy and practice in their respective schools. They are required to approve the school's budget and are entitled to receive information about the primary purpose of their school, that is, the progress and achievement of student learning. However, the focus of governing authorities should be on governance, rather than considering which brand of hardware to purchase and at what cost. These authorities need to ensure (via their principal and staff) that all elements are in place, and that all students in the school not only have access to learning experiences and opportunities with ICT but that they also achieve and make progress with such learning.

A learning community that is determined to bring about change and implement or further develop teaching and learning with ICT in its school should find these goals easier to achieve if it utilizes the elements in practice at Central School.

Summary

This paper reviews the main findings of the research carried out at Central School. The main message of the research is that schools must consider: *why* they include teaching and learning with ICT in the curriculum; *what* outcomes, through learning experiences and opportunities, they intend for their students; and *how* the processes and practices of teaching and learning with ICT should be implemented. The focus of the research carried out at Central School has been firmly placed on student learning. All elements of the research have been filtered through the question: "How does/will this serve our students?"

A model of the interrelated elements of the school-wide implementation of teaching and learning at Central School has been presented and discussed. The model emphasizes the importance of recognizing the complementary nature of its elements, and the need, through management, to ensure each element is in motion while maintaining its dynamic relationship with other elements.

The research has important implications for schools, governing agencies of schools and perhaps for education communities worldwide. The researcher contends that schools, through their principals and governing authorities, must take greater responsibility and become more accountable for student learning with ICT. To this end, a range of ICT teaching and learning issues has been listed for the consideration of schools. The researcher also suggests that the governing authorities must move more quickly to recognize the importance of student learning with ICT. Immediate research conducted at schools already known to be successful providers of teaching and learning with ICT is required. Such research is likely to form the basis of far more meaningful information for schools and governing authorities, and more specific directives in ICT teaching and learning. We are not likely to obtain the information we need, that is, what we should be doing in ICT with our students today and in the future, through any other method.

In conclusion, the research identified how one school, in a typical urban setting, has taken responsibility for teaching and learning with ICT. The research presents and interprets the compelling reports and experiences of the people of the Central School ICT learning community. Their stories, their voices, their data, and their teaching and learning in practice provide a rich account of the 'way they do things' with ICT. But when all is said and done the key to success in this field are the people involved in leading, managing and changing the processes and practices of teaching and learning with ICT. If the 'human infrastructure' is in place, and the ultimate goal of successful student learning remains paramount, it should be possible for any school to adopt and apply the elements of teaching and learning with ICT observed at Central School, with the same successful outcomes.

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Cross-Country Conversations: Techniques for Facilitating Web-based Collaboration

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Introduction

Imagine you are a member of the 21st Century Teachers Network. As an active participant, you will strive to: build your own expertise in using new learning technologies; share your expertise and experience with colleagues; use your expertise with students as part of the daily learning process; work to make classroom technology available to all students and teachers. This is what we asked our students to do.

This paper describes an online collaborative process between three university classes in a cross-country project. Recommendations are also provided to offer guidance on how to improve online collaboration.

Theoretical Background

Prior to facilitating an online collaboration project, we must first understand group development and dynamics in online environments. First, online environments and traditional classrooms produce different social environments (e.g., environments impact interactions and group dynamics in different ways). While the means of communicating are different in online groups, the developmental stages that groups proceed through remain the same as in traditional face-to-face situations (McDonald & Gibson, 1998). Online course developers need to be aware of these stages in order to create environments that will facilitate successful online collaboration.

Shutz (as cited in McDonald & Gibson, 1998) posits that all groups cycle through the interpersonal needs of *inclusion, control* and *affection*. According to McDonald and Gibson (1998) *inclusion* refers to the group member's need to be attended to and recognized as a distinct person. *Control* refers to a continuum where a person might want to be in control of the situation while others on the opposite end of the continuum may want to be controlled and have their responsibility lifted. *Affection* refers to the need of the group members to have cohesiveness, support, acceptance and trust (McDonald & Gibson, 1998).

McDonald and Gibson (1998) found that the differences in group dynamics in online courses are not based on how the groups develop, rather in how they are able to overcome the communication barriers imposed on the groups by the online environment. The implications for practice for the successful facilitation and management of group interactions were for online educators to encourage and model the appropriate collaborative behavior for the group and to create activities that would encourage sharing and cooperation. These two implications were intended to assist with addressing the *affection* need of the group development process. Additionally, they encouraged online educators to create activities that address the needs of *inclusion* and *control* in order to facilitate online collaborations further.

We will describe how our project addressed the group development needs of *inclusion, control,* and *affection* in order to facilitate online collaborations. We will also explain what we believe should be done in order to further meet the needs of the groups. The techniques used to facilitate collaboration were: online introductions, collaboration training, the use of thematic discussion topics and modeling and coaching.

The Project

Three "Computers in Education" classes were involved in the collaborative project. Two were undergraduate courses at different campuses of Indiana University, the Bloomington and Northwest campuses, and the third was a graduate course at North Carolina A & T State University. Each course was a traditional campus-based course whose instructors agreed to have their students participate in the cross-country collaboration. The students' participation in the cross-country collaboration accounted for only a small portion of their course grade.

Students were grouped into teams of four that worked together throughout the semester. We decided to have the teams stay intact throughout the semester in order to allow the groups to develop and build a cohesive collaborative team. There were 12 teams, most of which consisted of at least one student from each campus.

The project consisted of five two-week long online group discussions using SiteScape Forum, a Web-based discussion board and file-sharing tool. There were two main features of SiteScape that the students used, the 'user profiles' and the discussion boards. Each group had their own discussion area and there was a common discussion area for everyone in the three classes.

The method used to design and develop this project is discussed in detail in "Creating a Pre-Service Teachers' Virtual Space: Issues in Design and Development of Cross-Country Collaborations" (Reinhart, Anderson, & Slowinski, 2000).

Methods for Facilitating Collaboration

Collaboration Training

In the beginning of the semester each instructor provided the students with in-person basic training on how to work collaboratively with others in their online group. This training consisted of online collaboration techniques such as defining roles of members in the group, netiquette, establishing group goals, norms, etc. Additionally, we posted on the Web a few tips on collaboration techniques that addressed the specific group activities.

The goal was to provide students with training on how to work collaboratively with others online. We felt that the students needed to be aware of the complicated nature of collaborating in an asynchronous online mode as supported by McDonald and Gibson (1998). By providing training, we should have addressed all three interpersonal needs for group development and dynamics (*inclusion, control* and *affection*). For instance, we addressed *inclusion* by teaching the students about the importance of assigning roles to each member of the group. *Control* was addressed by explaining the importance of posting their summaries and synthesis drafts several days before the due date so that others could provide feedback, provide input, and truly collaborate on the final synthesis statement. We also addressed *control* by encouraging students to play a variety of roles in their groups and to rotate responsibilities. Finally, *affection* was addressed by teaching the students about netiquette, how to provide constructive criticism and the importance of keeping in constant contact with others in the group.

We trained the students on online collaborative techniques with the hope that they would move forward with their projects using these techniques and hopefully build strong, cohesive, collaborative groups.

Introductions

Prior to participating in the discussions, we asked the students to provide brief introductions of themselves. Additionally, we asked them to upload digital photos of themselves to their user profile in SiteScape Forum. The students were encouraged, but not required, to post their picture to their 'user profile' in SiteScape Forum.

We did the 'Introductions' for two reasons. First to promote the students' need for *inclusion* by allowing the group to get to know each other as individuals. Second, to ease students into using the collaboration tool. For many of the students, SiteScape Forum was a new tool. By providing the students with an opportunity to post introductory statements about themselves we gave them an opportunity to practice the rudimentary skills necessary for using SiteScape Forum in a non-threatening risk-free manner. The goal was to promote their sense of efficacy and enable them to participate in the online collaborations.

Thematic Discussions

The discussions incorporated the concept of cognitive apprenticeship (Brown, Collins & Duguid, 1989; Lave & Wenger, 1991). By situating a learner in an authentic context and having her participate as a legitimate member, she will become a conscious creative member of the community and find legitimacy in the tasks asked of her. In our case, we drew on the 21st Century Teachers Network in an effort to acculturate our students into authentic professional practices.

There were five discussions assigned throughout the semester. Each of the five discussions had an overall theme. Each student in the group was responsible for writing a summary of an article that was uniquely assigned to them. The articles were on subtopics of the overall theme. Then, after each student wrote her summary, the group then worked off of the individual summaries and collaborated on a synthesis statement for the assigned discussion question for that round. This approach is recommended by Bonk and Reynolds (1997) to facilitate students' cooperative and collaborative learning on the Web because it "...enhances their processing of material, and the overall sense of interdependence and accountability among group members."

The theme and question for the five discussions follow:

1. Equity: How can each student have equal access to technology to maximize his/her potential to learn?
2. Acceptable use: How can I protect each student and myself when I utilize technology in my classroom?
3. Software evaluation: What do I need to consider?
4. Technology funding: How can I improve my instruction through obtaining more and better computer hardware and software?

5. Integrating technology: Based on everything that you have learned this semester and the readings that you have read for this interaction, how can teachers integrate technology into their instructional situation?

While we assigned the students specific readings, they were encouraged to incorporate into their discussions information from personal experiences, other class materials, or other outside resources. The assigned articles were just a starting point.

The goal was to design the discussions in a manner that would assure that everyone in each group played an important role in the collaboration process. The idea was that each team member would be an "expert" in different facets of the thematic discussion, which helped with the *inclusion* element of group development and dynamics.

Additionally, the hope was to address the *affection* elements of group development and dynamics by having the students build off of each other's work in order to make a new group synthesis statement. Also, the manner in which the discussions were designed allowed students to have as much or as little control over their input into the group project.

Modeling and Coaching

Modeling appropriate online collaboration behaviors was one of the recommended methods that educators could use to facilitate online collaborations (McDonald & Gibson, 1998). Through modeling, we were addressing the *affection* element of group development and thus creating a safe learning environment of acceptance and trust (McDonald & Gibson, 1998).

The main methods for communication were SiteScape Forum and Email correspondence. If they did communicate with each other via Email we requested that they include the instructors in the recipient list. This request gave us additional opportunities to observe how the groups communicated with each other. Through these observations we were able to either coach the students or model appropriate online collaborative techniques if necessary. Because of the unique nature of each group, we were able to provide guidance based on each group's specific situation.

Additionally, some of the coaching was provided during traditional face-to-face conversations. Because each course met on a regular basis we found that many students asked questions/advice of their local instructors before or after class-time regarding this project. Regardless of the mode used to coach or model behavior we were careful not to give unidirectional guidance, meaning that our way was the only way to solve the problem. Due to the constructivist nature of this project we based our guidance on the unique needs of the group and allowed the students to choose to take the advice or go in their own direction as recommended by Duffy and Cunningham (1996).

Providing the groups with sample synthesis statements so that they could see successful collaborative statements was another modeling technique that we used. The statements that we selected were from the project's first round of discussions. Thus, they were authentic examples of synthesis statements. We were careful to select very different, yet successful, approaches to creating the synthesis statement in order to provide the students with multiple perspectives. According to Bednar, Cunningham, Duffy and Perry (1992), by providing multiple perspectives we enabled the learners to take from the statements what they felt was useful to their particular situation. This enabled the different groups to reflect on their own group situation and then modify their group strategies accordingly.

Project Reflection

After the project was complete, we reflected on the project, specifically on the techniques that we used to facilitate online collaborations. Our reflection process included an informal review of the following: our personal observations, electronic correspondence that was archived in SiteScape Forum and the Email that we received from the groups. We were unable to do a thorough analysis of the data because it came to our attention, late in the project, that some of the groups were corresponding with each other via Email and the instructors were not copied in on the correspondence.

By the time the second discussion was over, we felt that eleven of the twelve groups were progressing in the group development process (*inclusion, control,* and *affection*), some communicating better than others. However, one of the twelve teams was having extreme difficulties. Of the four students in the group only one appeared to be putting forth any effort with the project with little, if any, communication from the three other team members. The one student who appeared to be putting forth the most effort asked that she be reassigned to another group. Due to the extreme nature of their case, we were forced to break the team up and reassign the team members to other stronger groups. While we realized that changing the teams around mid-project could hinder some of the groups' dynamics we found the disruption necessary. We looked back at the results of the discussions, to see if changing the group memberships mid-project impacted the group outcomes. It appears that they were able to readjust and include the new individuals into their groups with little problem.

By the end of the project (the last two discussions), ten of the eleven teams appeared to have created a good group dynamic. By "good group dynamic" we mean the groups were functioning well together, individuals were taking care of their own group responsibilities, teammates were communicating and providing each other some type of feedback, and the teams were able to produce a final synthesis statement. However, one team appeared to be dysfunctional. This team simply was having great difficulties communicating with each other, individuals were not posting their article summaries, and no one appeared to know what was happening with their synthesis statements. Their fourth synthesis statement appeared to be rushed, it was full of typos, there was no coherent organization, and it didn't address the key issues. It appeared as though one person quickly put something together and posted it to the discussion board. It was clearly not a group effort. Additionally, by the time we were on our fifth and final discussion topic this team was unable to produce a group synthesis statement.

While we ended up with ten of the eleven teams having good group dynamics, meaning that they worked through the interpersonal needs (*inclusion, control* and *affection*) of group development, we found that, as the project progressed, several teams were having difficulties distinguishing between cooperation and collaboration. At this point it is important to explain our distinction between cooperation and collaboration. Panitz (1997) defines cooperation as "a structure of interaction designed to facilitate the accomplishment of a specific end product or group through people working together in groups." He defines collaboration in general terms as "a philosophy of interaction and personal lifestyle where individuals are responsible for their actions, including learning and respect the abilities and contributions of their peers" (Panitz, 1997). Bednar et al. (1992) provide a more descriptive definition of collaboration, to "...develop, compare, and understand multiple perspectives on an issue..." and "...to search for and evaluate the evidence for the (other) viewpoint." As you can see both cooperation and collaboration require good group dynamics. Further, cooperation is a necessary condition for collaboration (Panitz, 1997). Therefore, while we felt we were able to create an environment that fostered the development of well-functioning groups that were able to accomplish their tasks, we found that some groups needed more assistance than expected to move from cooperation to collaboration.

One way in which the lack of true collaboration manifested itself during the project was that some groups simply took the individual article summaries and simply "cut and pasted" the text together to create what they considered a synthesis statement. Individuals in the team would make comments on the "cut and paste" synthesis statement but they were not substantive comments. They were comments like, "nice job" or "I've fixed a few typos but other than that I think we should go with it." Hall and Hall (1991), who conducted a similar project, found that their students provided the same types of surface-level feedback. While these teams were cooperating, they were not collaborating.

Eventually, with coaching and modeling we were able to move most of the groups towards a more collaborative effort. In hindsight, we believe that we should have furthered our training on collaboration by discussing methods for substantively integrating each other's ideas and perspectives into one group statement that incorporates as an integrative whole everyone's ideas. Also, we should have done more coaching and modeling of appropriate online collaboration techniques for our students online. We recommend that you divide the groups up with one teacher being responsible for providing coaching and guidance to a subset of groups.

Looking specifically at some of the other techniques that we used to facilitate online collaboration, we found that not all students participated in the "Introductions." The students were not required to participate in the "Introductions" therefore they were not graded on this facet of the project. The few that did not participate in this initial activity were also those who didn't do well with the project. It is difficult to say if the lack of participation in the "Introductions" led to the students not feeling included in the group, which led to a poor group dynamic. If this was the case, their need for *inclusion* was not met. Another possibility is that the students who didn't participate in the "Introductions" simply didn't want to participate in the project whatsoever. Also, there were a few students, who did participate in the "Introductions" and had difficulty with the group project. With additional samples, we could make a more definitive statement on this issue. But, the tendency of students, who failed to participate in this activity and who did not participate throughout may prove to be an important marker for intervention in virtual collaboration projects.

Finally, we recommend the use of rubrics for grading both the individual and the group synthesis statements. The rationale for this is three-fold; 1) rubrics help instructors guide their instruction; 2) rubrics themselves can be instructionally illuminating, and 3) rubrics help with consistent and objective scoring (Popham, 2000). These attributes are important when there are multiple instructors/graders and when the students are working in a new arena and need some additional guidance. Due to the nature of this type of project, the rubrics should focus on the thinking and collaboration processes as well as the groups'/students' ability to defend their statements.

Conclusion

We believe the thematic discussions were for the most part successful. By the end of the project most groups were collaborating with each other. While the project was successful for the majority of the students, some students needed a little more assistance. These were the students who might not have had their interpersonal group needs met.

Acculturation simply does not happen over night. And, projects similar to this are an acculturation process. Virtual collaboration projects require students to participate in several activities that they were unfamiliar (Web-based collaboration) with in an unfamiliar environment (Web-based collaboration tool). Not surprising, we witnessed a gradual improvement in collaboration with each effort. As we coached the students and modeled online collaborative behavior, the quality improved. But, more importantly, as each group progressed through a social process, becoming more familiar with each other and moving through their interpersonal needs (inclusion, control and affection), the quality of the group process improved.

In addition, our intervention efforts yielded significant changes in student practice. Upon retrospection, we would have offered more examples and guidance during the initial discussion topic. In future iterations of this project, we would begin the modeling from the very beginning. We believe that these changes would have made the project more successful for all the students involved.

We base these statements on our reflection and our informal review of the materials generated by this project. Further research needs to be done to examine the impact of several factors: thematic discussions and the level of authenticity; the impact of modeling and rubrics in virtual collaboration; measuring interpersonal needs and the subsequent impact of reaching these in collaborative projects.

Recommendations

1. *Social.* Provide opportunities for the groups to get to know each other as individuals, possibly utilize Web-based collaboration tools that enable video to introduce one another before the project.

2. *Collaboration Training.* Provide students with training on how to collaborate in Web-based environments. Making sure that the training teaches students about online group processes, overcoming online communication barriers, and the difference between cooperation and collaboration.

3. *Thematic Discussions and Authentic Context.* In addition to designing thematic discussions, attempt to partner with a school, organization, or school board (e.g., your students could operate as consultants). By creating these types of partnerships, the authentic element of the project can be maximized and the concept of situated learning and cognitive apprenticeship can be realized.

4. *Modeling.* Actively participate with your students at the beginning in an effort to model appropriate collaboration etiquette and processes. Provide examples of quality collaboration processes and finished products. And, use rubrics to provide guidelines that focus on the thinking and collaborative processes as well as the groups'/students' ability to defend their statements

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Fostering Girls' Computer Literacy through Laptop Learning: Can Mobile Computers Help to Level Out the Gender Difference?

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Abstract

One of the goals of introducing computers to the classroom is to support students who are more reluctant to the use of technology or who do not have a computer at home in acquiring computer literacy. Studies have shown that these students are often girls. The goal of the present study is to find out if the difference between boys and girls in computer literacy can be leveled out in a laptop program where each student has his/her own mobile computer to work with at home and at school. 113 students from laptop and non-laptop classes were tested for their computer knowledge and computer confidence. Students from laptop classes outperformed students from non-laptop classes in computer knowledge while there was no difference in computer confidence. In comparison to the non-laptop classes, the gender gap in computer knowledge was much smaller in the laptop classes. In computer confidence, no harmonizing effect of the laptops was found.

Theoretical framework

Traditionally, girls tend to be less interested in computers, use them less often in their spare time and have a more negative attitude toward computers (Bannert & Arbinger, 1996; Brosnan, 1998; Metz-Goeckel et al., 1991; Okebukola, 1993; Shashaani, 1994). Consequently, they are often less computer literate then boys. The introduction of computers to the classroom is meant to help especially these disadvantaged students to become more computer literate. However, it has been observed that computer projects, particularly those where students share a computer, can easily be counterproductive: Students, who already know more about computers tend to dominate teams (at least technology-wise) when computers are used for collaborative work, while the non computer literate, i. e. mostly the girls, become mere observers (Kauermann-Walter & Metz-Goeckel, 1991). Thus, computer projects may benefit students with a high degree of computer literacy more than those they are actually meant for (Sinhart-Pallin, 1990). If every student gets his/her own computer, which can be used flexibly in and outside of the classroom, this problem might be overcome because every student gets the chance to learn about computers individually. However, so far no data exists to support this claim.

Data sources

The development of boys' and girls' computer literacy is one of the core questions that are investigated in a laptop program, which started in March 1999. In this program, approximately 300 students and their teachers from a German high school are gradually furnished with networked laptop computers. Over the course of four years, four cohorts of seventh graders will enter the program. Currently, 220 students and their teachers have entered the program, two 9th grade classes being in their third year, three 8th grade classes in their second and three 7th grade classes in their first year.

Method

In a review of different definitions of "computer literacy" (e. g. Higdon, 1995, Richter, Naumann & Groeben, 1999; Tully, 1996) and "Internet literacy" (Doyle, 1996, Levine & Donitsa-Schmidt, 1998; Richter et al., 1999) the following dimensions were identified as central to the construct:

1. theoretical and practical knowledge about computers (hardware, software) and the Internet (communication, information retrieval),
2. self efficacy/confidence regarding computers and the Internet
3. responsible use and critical reflection regarding computers and the Internet.

Accordingly, a computer literacy test was developed for this study. Existing questionnaires and tests for computer literacy were considered and adapted/updated for the purpose of this study (e. g. Pelgrum, Janssen Reinen & Plomp, 1993; Richter et al., 1999). The resulting test includes the following seven scales:

1. CONF_COM: Confidence in using computers: Rating scale for self-assessment of the students' subjective level of confidence in using computers (confidence)
2. CONF_INT: Confidence in using the Internet: Rating scale for self-assessment of the students' subjective level of confidence in using the WWW to find information and in using e-mail (confidence)
3. COM_TOOL: Computers as tool or toy: Rating scale to measure students attitude towards computers and the Internet (tool or toy/critical reflection)
4. HW_OS: Knowledge in hardware (PC) and operating system (Windows95/98): Test items with one right answer and three distracter alternatives (theoretical and practical knowledge)
5. OFFICE: Knowledge in common office applications and presentation software (MS Word, MS Excel, MS PowerPoint): Test items (see above, theoretical and practical knowledge)
6. INTERNET: Knowledge in using the WWW for search tasks and in using e-mail: Test items (see above, theoretical and practical knowledge)
7. SECURITY: Knowledge in basic security issues (virus protection, passwords): Test items (see above, responsible use/critical reflection)

In addition, the test included items measuring descriptive data, e. g. the students' age and gender, access and use of computers at home and at school, access and use of the Internet.

In November 2000, the test was distributed to 45 students from two laptop classes (9th grade, age 14-15), who are in their third year of laptop use and to 68 9th graders from the same school who do not use laptop computers but have regular access to the school's computer labs.

Results

Descriptive analyses of the sample showed that home access to computers was almost equal in both groups: all of the students in the experimental as well as in the control group reported having a computer at home. However, in the control group only 54,4% have their own computer while in the experimental group every student has his/her own laptop computer. On average the computer is used every day in the experimental group (Median = 6 (= daily)), while in the control group it is slightly lower (Median = 5 (= several times per week). Considerable differences exist in the use of computers at school. While the laptop students reported having used the computer almost daily (Median = 5), the control group students reported having used a computer only one to six times throughout the school year (Median = 1).

Before results of the computer test were analyzed, some basic test statistics and item analyses were carried out. To increase internal consistency, one item was excluded from scale COM_TOOL and OFFICE respectively. Table 1 shows the test and item statistics for the remaining items.

	M_{Skala}	SD_{Skala}	N	R	r_{it}	P	α
CONF_COM	26.55	4.76	7	7-35	.50	.76	.78
CONF_INT	25.59	4.94	7	7-35	.48	.73	.76
COM_TOOL	22.39	4.35	6	6-30	.51	.75	.75
HW_OS	3.88	1.82	6	0-6	.47	.65	.72
OFFICE	4.03	3.39	8	0-11	.62	.38	.84
INTERNET	3.02	2.33	9	0-9	.40	.39	.72
SECURITY	1.68	1.22	5	0-5	.25	.34	.46

Table 1: Test and item statistics

(M_{Skala}: scale mean, SD_{Skala}: standard deviation, N: number of items, R: range, r_{it}: mean item discrimination coefficient, P: mean discrimination power, α: standardized Cronbach's alpha)

The effect of the use of laptops on boys and girls was determined using a 2-factorial, multivariate analysis of variance (GLM) with laptop/non laptop as one factor and gender as the other factor and the seven scales of the computer test as dependent variables. To test if the homogeneity assumption for this procedure was violated, a Levene test for homogeneity of variances was carried out. For four of the seven scales, a violation of the homogeneity of variance assumption was detected (see table 2). Generally, it is assumed that the F statistic is robust against such violations (Bortz, 1995). However, in these cases, non-parametric tests were calculated to verify the main effects found.

	F	df1	df2	α
CONF_COM	.821	3	99	.485
CONF_INT	.564	3	99	.640
COM_TOOL	3.817	3	99	.012
HW_OS	8.990	3	99	.000
OFFICE	10.739	3	99	.000
INTERNET	2.918	3	99	.038
SECURITY	1.913	3	99	.132

Table 2: Levene test for homogeneity of variances

(design: Intercept+GENDER+LAPTOP+GENDER * LAPTOP)

Overall, the multivariate test (Wilks-Lambda) showed significant main effects for LAPTOP and GENDER. The interaction of LAPTOP and GENDER was not significant on the multivariate level (see table 3).

Effect	Value	F (exact)	Hypothesis df	Error df	Sig.
Intercept	,015	869,349	7	93	,000
SEX	,745	4,541	7	93	,000
LAPTOP	,276	34,800	7	93	,000
SEX * LAPTOP	,911	1,291	7	93	,263

Table 3: Multivariate tests (design: Intercept+GENDER+LAPTOP+GENDER * LAPTOP)

Gender effects

To help interpretation of the differences found, interaction plots were created (see Fig. 1 and 2). The pattern is similar for most of the scales. Girls in the control group scored consistently lower than boys on almost all of the subtests. In the laptop group, lower scores were only found for the general confidence in using computers, for the knowledge on hardware and the operating system and for the knowledge on security issues. On the COM_TOOL and the OFFICE scale girls of the experimental group scored slightly higher than boys.

To investigate the statistical significance of the descriptive differences found, between-subjects effects were calculated for each variable based on the GLM. The factor GENDER was significant for the variables CONF_COM (F(1, 99) = 14.58, p = .000) and HW_OS (F(1, 99) = 8.75, p = .000)[1]. Furthermore, the factor approached significance for the variables CONF_INT (F(1, 99) = 3.09, p = .082) and SECURITY (F(1, 99) = 3.48, p = .065). Thus, gender differences seem to occur particularly in the subjective confidence of boys and girls regarding the use of computers and the Internet, and regarding the rather technical areas of computer use.

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[1] A Man-Whitney U-test confirmed this result.

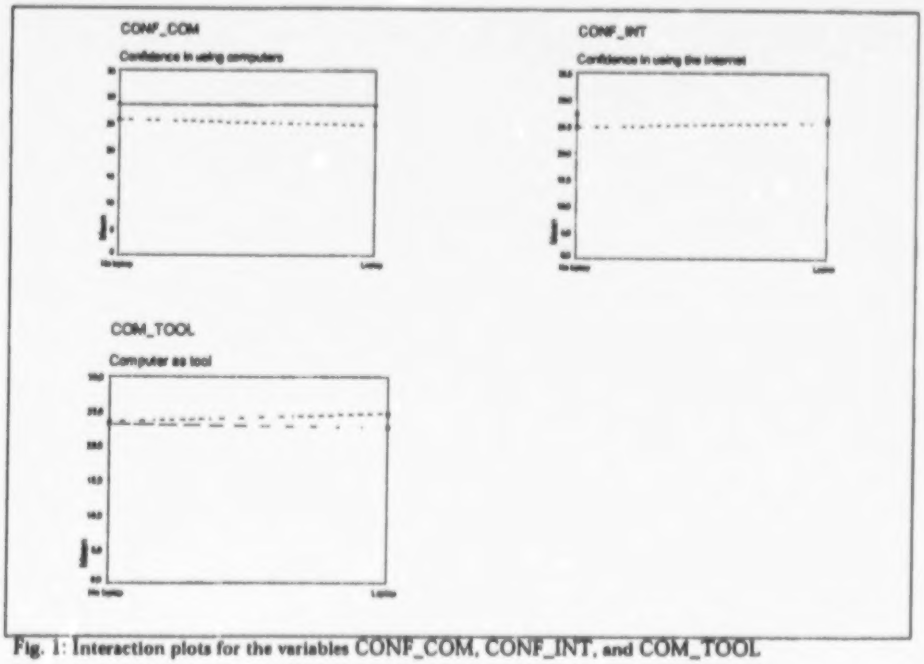

Fig. 1: Interaction plots for the variables CONF_COM, CONF_INT, and COM_TOOL

Boys ———

Girls --------

Laptop effects

As can be seen from Fig. 1 and 2, the use of laptops has only impacted the knowledge about computers (hardware and operating system, office applications and Internet) but not the subjective confidence in using computers or the Internet. Gains were particularly high for office software, which was also used most frequently in the laptop program, while only moderate knowledge was gained in the area of hardware and operating system and of the Internet. For the scale SECURITY, laptop students were found to score slightly lower than the control group students. Verification of the between-subjects effects for the factor LAPTOP showed significant effects for the variables HW_OS (F(1, 99) = 188.03, p = .000), OFFICE (F(1, 99) = 202.27, p = .000) and INTERNET (F((1, 99) = 8.74, p = .004), corroborating the pattern identified in the interaction plots[2].

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[2] Man-Whitney U-tests confirmed these results.

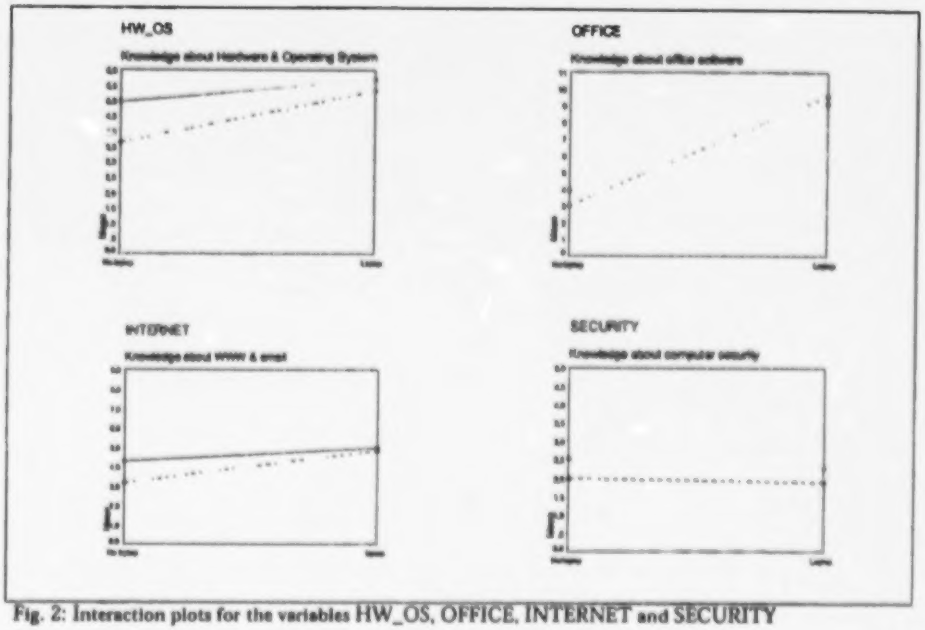

Fig. 2: Interaction plots for the variables HW_OS, OFFICE, INTERNET and SECURITY

Boys ———

Girls - - - - - - - -

Interaction of gender and laptop

The plots reveal some interesting interaction patterns. For three of the four scales, which measure computer knowledge, girls show a higher relative gain than boys, thus reducing the gender difference in comparison to the control group. In one case (office applications) girls of the laptop group even outperformed the boys. Among the knowledge tests, only the performance on the SECURITY subtest shows no interaction of laptop use and gender.

In contrast, the plots of the two scales that measure the students' confidence in using computers and the Internet and the computer-as-tool scale show no differential effect. Regarding computer confidence, girls score lower than boys in the control as well as in the experimental group. The scores for Internet confidence of girls and boys lie close together in both groups. Again, there is no clear effect of using laptops for either the boys or the girls. The same is true for the students' attitude toward computers as tool. Differences are rather small and difficult to interpret.

The descriptive interaction could not be definitely verified, as there were no significant interactions in the between-subjects tests. In two cases however, the interaction of GENDER and LAPTOP tended to be significant. These were the variables that also show the highest relative gains of the girls in comparison to the boys, HW_OS (F(1, 99) = 2,86, p = .094) and OFFICE (F(1, 99) = 2.89, p = .092).

Conclusion

Although boys and girls in this study where equipped with computers almost equally well, the results show that the participation in the laptop program had a significant effect on students' computer literacy. In particular, the project fostered their knowledge of computer hard- and software as well as their knowledge on using the Internet for information retrieval and for communication. The only knowledge subtest where no difference was found between laptop and non-laptop students was the knowledge on security issues. A likely reason for this is that security issues were not dealt with in the laptop classes, while hardware and operating system, office software and the use of the Internet (particularly for information retrieval) where explicitly covered within the subjects' curricula. The subjective confidence in using computers and the Internet was not impacted by the project however. Different explanations might account for this finding. All students (laptop and non laptop) were relatively experienced in using computers (all of them had access to a computer at home and on average used it several times per week or more often). Since many studies have shown that computer experience is directly related to computer confidence (e. g. Levine & Donitsa-Schmidt, 1998; Rosen & Maguire, 1990), the finding that computer confidence was high in both groups is not surprising. In addition, the finding might be attributed to a ceiling effect, because the mean discrimination power of both confidence scales is rather low (see tab. 1). In order to find out if participation in the laptop program can increase computer and Internet confidence of students, the discrimination power of the scale should be increased.

The effects described above were particularly true for girls. In comparison to the girls of the control group, the girls in the laptop group had considerably more knowledge of computer hard- and software and of the Internet after participating in the project. The gender gap between boys and girls in computer knowledge was much smaller in the laptop classes. On some of the subtests it disappeared entirely. Thus, it can be concluded that the ownership of an individual computer and the extensive use of the machine in the school context contributes to leveling out gender differences in computer literacy. Surprisingly, the gain in computer knowledge did not have an impact on the girls' computer confidence. The gap in computer confidence between boys and girls did not close in the laptop classes. The reason for this is not clear. While the gender difference in computer confidence is often interpreted as a lack of confidence on the part of the girls, it could also be that the boys are over-confident in their computer skills. Possibly, girls are more aware than boys of how much they do not know about computers, and thus do express less confidence in their computer skills. Another explanation might be that the prejudice that girls are less technically apt then boys, which is deeply rooted in the female role model, impacts the girls' feeling of self-confidence with computers. In this case it would be necessary to foster girls' self-confidence so that they judge their computer competence more appropriately. In any case more research is needed to find out what exactly determines self-confidence in using computers. Also, the results warrant for caution when computer literacy is measured by self-assessment only, as self-assessment scales might be systematically distorted.

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Commonalities in Educational Technology Policy Initiatives Among Nations

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Introduction

While education systems from nation to nation differ significantly according to national character and local requirements, developments in public policy initiatives regarding the use of Information and Communications Technology (ICT) in schools have followed similar patterns among nations and political units as diverse as the United States, the European Union, Great Britain, Denmark, Germany, Italy, Victoria, Australia, Singapore, Japan, Viet Nam, Mexico and Brazil. Specifically, initiatives for public investments in ICT tend to fall into common categories: investments in introducing computer workstations into schools accompanied by initial technology training for teachers are followed by investments in infrastructure and connectivity accompanied by further professional training in both ICT skills and integration of ICT in classroom instruction while attempting to define effective practices. The commonalities in such initiatives seem to stem from the emergence of a global digital economy and society rooted in the evolution of ICT since the birth of the Web, which has produced a species of education reform that has taken on an unprecedented global character, regardless of performance of or local satisfaction with an educational system. Further, the commonalities appear to have evolved reactively to a combination of opportunity and pressure, with rational decision-making inadequately applied either to public policy or instructional decision-making. The result is the emergence of issues of effectiveness not yet addressed that must be resolved to enable nations, schools and communities to obtain an adequate return on their extensive investments in ICT.

Methodology

This paper is an episodic rather than systematic analysis of international initiatives. It is based on two and a half years of participant observations in international meetings, collaborations, consultations, project planning and negotiations, supported by key document reviews that together form the picture that emerges below. The participant observations were not originally undertaken with the intent to do field research, but rather were consequences of work assignments for IBM's education business and Reinventing Education program that involved interacting with various ministries, education authorities, and community leaders as business opportunities emerged in regions around the world. It wasn't until about a year ago that a sufficiency of cases had accumulated that the possibility of codifying repeating occurrences became apparent. The result was an attempt to capture retrospectively both the essence and specifics of the cases *vis a vis* the hypothesis above: that emerging economic and social realities had driven common approaches to education reform that have been more reactive than rational.

Three kinds of cases formed the data sources for this paper. The first were business opportunities, which usually consisted of a briefing and discussion directed at determining the presence or absence of a possible sale of products and services. During such sessions, information about the state of technology presence and integration, and priorities for educational initiatives both with and without technology were routinely exchanged. Of the 100 documented meetings, activities and projects that occurred from January 13, 1999, through June 12, 2001, that form the total source base,[1] 62 were of this type with numerous telephone and e-mail communications associated either with preparation or follow-up taking place as well. Examples include meetings with schools and school authorities such as:

- Haram-modellen, Norway,
- Aarhus, Denmark,
- Toulouse, France,
- Essex, England,
- Outram School, Singapore, and
- Mitaka City, Japan.

Additionally, a number of similar meetings were held at the senior civil service and ministerial level. Selected examples include meetings with:

- Estelle Morris, then Minister of Standards and now Education and Skills Secretary, U.K.,
- John Elvidge, Secretary and Head, Education Department, Scottish Executive,
- Pascal Colombani, Director of Technology, Ministry of Education, France,
- Paul Eschbach, Section Chief, Ministry for Schools and Further Training, Science and Research, North-Rhine Westphalia, Germany,
- Wee Heng Tin, Director-General of Education, Singapore, and
- Nicky Capponi, Manager, Centre for Technology Supported Learning, DEET, Victoria, Australia.

Finally, industry trade shows such as BETT, held in London each winter and attracting over 400 exhibiting companies and over 20,000 visitors from 76 countries,[2] offered concentrated opportunities to interact with a wide variety of both users and providers of technology in education.

The second case type were formal, invited addresses to international audiences. Examples include:

- the NAHT Conference, October, 1999,
- a Singapore Ministry of Education school administrators' plenary, September, 1999,
- the EUN Schoolnet Conference, March, 2000, and
- the Edinburgh Science Festival, April 2001.

While such sessions consisted primarily of the dissemination of the speaker's views regarding technology in schools, the inviting government or organization requested the topics. The sessions also offered invaluable feedback and confirmation on the appropriateness of those views to international venues.

The third case type were project planning negotiations surrounding opportunities for international Reinventing Education projects, philanthropic projects funded by IBM's International Foundation to generate solutions and solution models for the effective use of ICT in schools patterned after the Reinventing Education program sponsored by IBM in the U.S., and ongoing Reinventing Education projects.[3] Examples include:

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[1] APPENDIX A contains a complete list of all meetings and key informants. Note that some meetings were not finite in nature, and involved ongoing collaboration and/or multiple party participants such as during the BETT and TWL Trade Shows. Yet other meetings served more than one purpose.

[2] http://www.bettshow.com/bett/default.asp?SectionName=bett_About&Group=V

[3] APPENDIX B contains summaries of the eight active international Reinventing Education projects. Additional information about Reinventing Education can be found at http://www.ibm.com/ibm/ibmgives.

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- The Singapore Ministry of Education, Instruction and Assessment Transformation Project
- Mitaka City, Japan, Period of Integrated Study Proposal
- Toulouse, France IUFM and Academie, ICT-based Improved Performance In ZEP Schools Proposal
- The U.K. Department for Education and Employment (now the Department for Education and Skills), Beacon Schools Dissemination Project

Because these cases require the identification of critical issues for school transformation and negotiation of agreements between governmental units and IBM, they have been highly revealing of the policy directions and priorities felt at both the governmental and operational levels of education in the participating regions.

The model for thinking about patterns of investment and policy stems from the Four Pillars of U.S. education technology policy objectives established in 1996 by the President and tracked since that time by the CEO Forum on Education and Technology.[4] The Pillars focused on Hardware, Connectivity, Content and Professional Development, and set a target for action by schools and education governing bodies. The challenges issued were:

- **Hardware**
  All teachers and students will have modern multi-media computers in their classrooms.
- **Connectivity**
  Every classroom will be connected to the information superhighway.
- **Content**
  Effective software and online learning resources can increase students' learning opportunities.
- **Professional Development**
  All teachers in the nation will have the training and support they need to help students learn using computers and the information superhighway.

The establishment of the Four Pillars as policy led to the creation of new programs and the application of funds from existing programs such as

- the Technology Literacy Challenge,
- Technology Innovation Challenge Grants,
- PT3 (Preparing Tomorrow's Teachers to Use Technology) Grants,
- Title I grants for basic and advanced skills, and
- E-rate discounts

that in 2000 supported technology initiatives in U.S. schools to the level of approximately $7 billion, $1.5 billion of which came from federal sources other than e-rate.[5] Given the financial and policy focus on educational technology implementation, the CEO Forum, a consortium of technology providers, digital content providers and education organizations, was established to track progress in these areas and study movements in practice such as the growth in professional development allocations from technology budgets from under 7% two years ago to a recommended 20% in the current version of the Senate education bill.[6] It was the CEO Forum's findings over the duration of its existence of clear movement in the Hardware, Connectivity and Professional Development Pillars coupled with less clarity in the Content Pillar and the strong need for research on what works expressed in its final, newly released report on Accountability, coupled with the hardware, connectivity and professional development focuses and increasing interest in demonstrated best practices that emerged from the 100 cases referenced above that suggested the possibility of a pattern of commonalities that evolves naturally in response to economic, social, institutional and political circumstances and pressures, and which might be reflected by any system experiencing those same circumstances and pressures.

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[4] School Technology and Readiness Report: From Pillars to Progress, The CEO Forum on Education and Technology, October 9, 1997 pp 7-8

[5] The Power of the Internet for Learning: Moving from Promise to Practice, Report of the Web-Based Commission to the President and Congress of the United States, pp. 118-119

[6] http://www.ceoforum.org. All reports from the Ceo Forum can be downloaded from that site.

The Context- Fuel for the Global Digital Economy

The drive toward increased investment in ICT in various locations around the globe stems from a simple reality: the unprecedented growth of a global digital economy and society as the single largest fundamental transformation in the world's social and economic structure since the industrial revolution, with immediate and dramatic implications for education. Federal Reserve Board chief Alan Greenspan put the impact in perspective when he said,

> "What differentiates this period from other periods in our history is the extraordinary role played by information and communication technologies. The effect of these technologies could rival and arguably even surpass the impact the telegraph had prior to, and just after, the Civil War."[7]

John Glenn underscored the educational implications when he wrote in a report to the U.S. Department of Education, "Times have changed. In an integrated, global economy, whose key components are increasingly knit together in an interdependent system of relationships, will our children be able to compete?"[8] The same concerns caused the German government to establish an initiative called D21 in 1999 to

> "...boost competitiveness in Germany's economy, generate new markets, create new workplaces and reform and 'informatize' education..." to enable German youth to develop the skills necessary to be successful.[9]

According to Yeow Cheow Tong, Singapore's Minister for Communications and Information Technology, Singapore's

> ...aim is to equip infocomm workers with the right mix of business skills and up-to-date technical competencies so that they can succeed in the competitive global Internet economy... For students, the Ministry of Education's target is to have 30% of the school curriculum computer-based. This will pave the way for our students to be infocomm-savvy.[10]

The French government asserted the importance of ICT in January, 1998, in the Prime Minister's plan "Preparing France's Entry into the Information Society," with education the first of the six priorities established.[11] In Australia, the Department of Queensland Education has developed a

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[7] "Fed chief: Tech is driving productivity," USA Today Online, http://www.usatoday.com/life/cyber/invest/in770.htm, June 13, 2000

[8] Before It's Too Late: A Report to the Nation from the National Commission on Mathematics and Science Teaching for the 21st Century, Education Publications Center, USDOE, September, 2000, p 4

[9] http://d21.fujitsu-siemens.com/d21/english/d21_en.htm; Appendix A, #55, Paul Eschbach, 9/27/00

[10] "Strategies for Developing Manpower in the Sector," Yeo Cheow Tong, Speech to the Singapore Computer Society, March 4, 2000.

[11] APPENDIX A, #49, Pascal Colombani, 2/22/00

New Basics Plan intended to prepare students for the "new blend of skills and competencies" required by "new technologies, globalised economies and communications media...."[12]

Transformations in the global economy are here to stay, regardless of the recent slow-down in the U.S. economy. In discussing the downturn, Federal Reserve Board Governor Laurence H. Meyer explained how the recent period of technological innovation has created a vibrant economy in which opportunities for new jobs and businesses blossomed; and while challenges clearly exist, dramatic gains in innovation and technical change have driven productivity.[13] These gains are, in Greenspan's words, "structural gains in productivity,"[14] and as government after government has attested, the fuel for the technology-based productivity engine is a growing, highly trained, ICT-enabled workforce.

The direct line between the need to support a dynamic, expanding economy through the investment in and integration of ICT in public education has been both simple and quick for nations and communities to draw- and the consequences for failure to act in lost opportunity and unfilled jobs has been easy to track. ITAA's 2001 report, *Bridging the Gap*, found a job market where one in every 14 U.S. workers was involved in information technology and where one in every 12 IT jobs went unfilled for want of an appropriately skilled applicant.[15] In Singapore, Yeo Cheow Tong noted that

> "...with the rapid emergence of the Net Economy... the industry has projected that it will need 250,000 workers by the 2010. This is more than two-and-one-half times the current infocomm manpower of 93,000 that is being employed across all industries. This projection may appear on the conservative side, since International Data Corporation [IDC] has predicted that the global Internet economy will grow by 56% per year for the next 3 years."[16]

IDC Research reported a projected shortage of 1,000,000 IT professionals for Europe by 2002, threatening European growth and economic competitiveness. The marketing research firm also projected a worldwide deficit for the same year of 2,000,000 IT workers.[17] Additionally, the European Information Technology Observatory (EITO), noted that while the worldwide IT industry creates about 600,000 jobs a year, more than 100,000 additional jobs could be created if industry could find sufficiently skilled people.[18]

Thus, a global competition has emerged, driven by the quest for economic advantage that revolves around a race to improve the development of a knowledgeable, skilled workforce. We now see politicians running for office to be the Education President or, as in the case of Tony Blair, on a platform of education, education, education. We now see marketing tracking agencies such as the Computer Industry Almanac and QED following the rate of computer and Internet penetration into the population, and governmental agencies such as the USDOE's National Center For Education Statistics and the U.K.'s Department for Education and Employment measuring the ratio of students to internet-enabled, multi-media computers. Of the 100 cases documented in APPENDIX A, not one failed to indicate at some point in discussions, proposals, policy documents or program initiatives the crucial role of ICT in education to enable the development of a skilled workforce for growing a competitive 21st century economy. The competition is palpable, as Ralph Tabberer of the U.K.'s Teacher Training Agency indicated when he saw a comparison of his country's Internet penetration to that of other nations. "The U.K. is twelfth?" he said. "We're going to change that!"[19] It is this reality that has driven a common pattern of response to ICT integration and education transformation in various regions of the world.

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[12] *Draft New Basics Technical Paper*, Version 3, 3 April 2000, pp 5-6; APPENDIX A, #68

[13] *What Happened to the New Economy?* Remarks by Laurence H. Meyer before the New York Association for Business Economics and The Downtown Economists, New York. June 6, 2001.

[14] Greenspan, June 13, 2000

[15] http://cnnfn.cnn.com/2000/04/20/career/q_it_shortage/

[16] Yeo Cheow Tong, March 4, 2000

[17] http://www.nua.ie/surveys/index.cgi?f=VS&art_id=905355296&rel=true, September 23, 1999

[18] http://www.iht.com/IHT/SUP/052799/car03.html, May 27, 1999

The Commonalities

Prior to the spectacular growth of the World Wide Web in 1994, the introduction of computers into schools was considered desirable, but hardly imperative. The purposes for hardware purchases ranged from making new tools like word processors available to providing interesting instructional support materials for specific educational objectives to introducing computer literacy and even programming concepts to simply being innovative. Little urgency existed to drive investments, and decisions to buy were essentially discretionary and even adventuresome. Training for teachers was generally focused on using the technology, and included matters such as file management and disk handling. While differences could be found from implementation to implementation, and models for effective integration had evolved,[20] the use of computers in teaching and learning had little institutional impact during that period. As a result, local conditions predominantly determined the approach to and perceived value of technology in education. Such was the circumstance that caused one early provider of educational hardware and software in 1991 to conclude that, after on-site investigations, solutions created in the U.S. could not be successfully remarketed in Europe or even in Canada.[21] But then, the marriage of information technology and communications technology had not yet occurred, and the global digital economy had not yet been born.

Just seven years after the initial release of the first commercial graphical Web browser, the urgency of investment in ICT is now virtually universally accepted. The OECD is engaged in various studies on the role of technology in education for spurring community development among its 30 member nations,[22] and there is even a guide now available from Harvard's Center for International Development, replete with exemplars from countries such as India, Chile, Peru and Tanzania, to help developing nations plan for establishing and using the productive capacities of technology.[23] Inquiries about the use of computers in classrooms come by e-mail from all parts of the world, including requests from India's SchoolNet project and queries from Nigeria about reading using computers.[24] One of the Reinventing Education projects is focused on integrating computer-based instructional programs into classroom practice in Viet Nam using the same content and methods employed in many school districts in the U.S.[25]

The similarities in focus and attention relative to the implementation of ICT in education that have emerged are striking, and have moved far beyond the early days of buying computers and providing technology training. These commonalities lie in three main areas: infrastructure, professional training, and a drive for improved results.

Infrastructure

The U.S. Congress established the e-rate in 1996 to enable schools, and particularly the poorest schools, to get online. At roughly $6 billion expended exclusively on communications networking by the end of 2000,[26] this investment is clearly one of the most (if not the most) impressive in the world. It is not the only example, however, of key investments to foster ICT in schools. The U.K.'s National Grid for Learning (NGfL), for instance is funded at a more modest level of $1.6 billion over four years, and includes support for Internet-based teaching and learning and the management of education, and actually establishes a national education network.[27] In fact, many nations have built ICT networks for schools. Twenty-three nations in Europe, including, among others, the U.K., Ireland, France, Slovenia, Israel, Greece and Portugal have formed a network alliance called EUN Schoolnet, termed by the EUN as a network of networks, and funded by the member Ministers of Education and the European Commission. EUN Schoolnet itself provides significant multi-lingual resources and activities in support of pan-European ICT integration and use in schools.[28] Australia has a similar network, EdNA that is owned mutually by all the Ministers of Education and Training from the states and territories.[29] Singapore, through its Masterplan for IT, the Ministry of Education Web sites, and Sing ONE, a national broadband network, provides broad support for the development of ICT at all levels of education.[30] Japan's investments include the Advanced National Education Network linking 2000 schools in all 44 prefectures and an increasing focus on broadband networks.[31] Differences in approach from network to network exist, but all represent funded policy initiatives and are focused on creating linkages and resources to facilitate ICT-based education.

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[19] APPENDIX A, #20
[20] http://www.apple.com/education/k12/leadership/acot/library.html
[21] Personal communication with Robert W. Mendenhall, President, WICAT Systems, May 14, 1991
[22] APPENDIX A, #2; see http://www.oecd.org/els/education for current reports.
[23] http://www.readinessguide.org/vignettes.html
[24] Personal e-mails from Louise Davis, 8/10/200 and Esat Feria, 2/6/01
[25] APPENDIX B, #72
[26] http://www.benton.org/e-rate/pressrelease.html.

Professional Development

In 1999, the CEO Forum published its Year 2 report on Professional Development for integrating technology with teaching and learning.[32] In that report, the CEO Forum made two key points that have profound implications for training teachers to use ICT effectively:

1. Training teachers on the basics of technology is insufficient to develop effective models of technology integration in classrooms,[33] and

2. Training for effective technology integration is a continuous improvement process best focused on results.[34]

Since the publication of that report, the federal PT3 (Preparing Tomorrow's Teachers to Use Technology) program was funded at $75 million in 2000, and, with many other state, local and federal investments, drove the total expenditures as a percentage of the nation's technology expenditures in schools to nearly 20%. Again, though the magnitude of investment by the U.S. is large, other nations are also investing significantly in the same endeavors. In the U.K., for instance, $363 million in New Opportunities Funds (NOF) are dedicated to training teachers to use technology in their specific areas of curricular expertise to meet the requirements of the National Curriculum. Every one of the national networks listed above has a professional development component, and in some instances such as Singapore's Teachers' Network, Germany's e-initiative.nrw, and Denmark's Sektornet, the teacher focus is primary.[35]

Another powerful indicator of common interest in effectiveness-driven, classroom integration-oriented professional development is the focus seen in all of the Reinventing Education projects. Even the Viet Namese project referenced earlier, though categorized by both IBM and the Ministry as a content project, has a focused teacher training component involving Hanoi Teacher Training College.[36] Similarly, the project in the State of Rio, though dealing with the need to improve science instruction, is an ICT-based professional development program employing online collaboration tools.[37] Ireland, Italy and Mexico are all engaged in using online collaboration tools to prepare teachers to use ICT more effectively,[38] while Singapore is using similar tools to explore transformations of conventional practice in their schools by introducing new methods of teaching and assessing student performance using ICT.[39] Overwhelmingly, education policy makers around the world have come to understand that realizing the potential benefits of ICT investments is wholly dependent on the preparation of teachers to carry out effectively new models of instruction.

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[27] APPENDIX A, #11, 4/19/99, 5/24/99
[28] APPENDIX A, #3; http://www.eun.org/eun.org2/eun/en/about/sub_area.cfm?sa=87
[29] APPENDIX A, #69, 8/23/00; http://www.edna.edu.au/EdNA
[30] APPENDIX A, #57, http://www.s-one.gov.sg/overview/it2k01.html; http://www1.moe.edu.sg
[31] APPENDIX A, #66 and #67
[32] *Professional Development: A Link to Better Learning*, CEO Forum, http://www.ceoforum.org
[33] *Ibid.*, STaR Chart
[34] *Ibid.*, pp. 12-15
[35] APPENDIX A, #63, #55, #46
[36] APPENDIX B, #72

The Drive for Improved Results

One problem with revolutions, whether political or economic, is that they often require action before all matters can be fully considered. And while *carpe diem!* may make a terrific motto, it may not be the best method of public policy formation. On the other hand, if shots are flying and bombs are bursting, asking to think things through for a few years probably won't bring about a cease-fire. There can be little doubt that much of the pressure to place computers in classrooms, build communications infrastructure and education networks, and train teachers in using the new tools came from the burgeoning new economy and the urgency to address the implications within educational institutions in time to meet new demands before windows of opportunity closed. And though the investments in ICT for schools were made with clear strategic vision, it doesn't mean that the implications were always understood or the details of implementation were always worked out.

Two Reinventing Education cases have been concerned about the implications of this for some time. Victoria, Australia, has a long history of excellence in the use of ICT in schools. It is noteworthy that while recent information out of the National Center for Educational Statistics in the U.S. reports roughly 2/3 of U.S. teachers feel at best only somewhat prepared to integrate technology into classroom instruction,[40] 2/3 of Victoria's teachers report "routine use" of ICT in their classroom activity.[41] Yet Victoria is still investing in a Reinventing Education project to study, through action research, effective practices with ICT to build a cadre of sharable expertise within Victoria's schools to enable broader dissemination of those practices.[42] The Standards and Effectiveness Unit in the U.K. was originally formed early in Tony Blair's first administration to focus on improving standards of performance in the U.K. through the identification and dissemination of demonstrated effective practice.[43] One of the key programs developed for accomplishing this purpose is called the Beacon Schools program. The U.K.'s Reinventing Education project focuses on the dissemination aspects of the Beacon Schools program, seeking to use ICT as a means of defining and facilitating methods of disseminating effective practice.[44] It is interesting to note that the relatively recent focus in the U.S. on accountability has focused more on funding conventional objectives measurement than on research and dissemination of effective practices.

Conclusion

The urgency to introduce ICT into classrooms around the world has stemmed from fundamental transformations in the economic and social context in which schools exist. This is as it should be, as schools serve the societies that create them. If there is an increasing consistency in how nations approach the issues of integrating technology into their schools, it is perhaps because of the increasing similarity of social and economic structures in which all our schools exist.

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[37] APPENDIX B, #75
[38] APPENDIX B, #73, #76, #78
[39] APPENDIX B, #77
[40] "Teacher Use of Computers and the Internet," USDOE National Center for Educational Statistics, April, 2000
[41] APPENDIX A, #69, 8/23/00
[42] APPENDIX B, #79
[43] APPENDIX A, #8
[44] APPENDIX A, #74

The speed with which these events have unfolded, however, leaves questions unanswered. Some of these have already been asked: Do we know what practices are effective? Do we know how to train our teachers so they can implement these practices? But beyond those questions lie some others that must be asked and answered: Do we know yet what changes our economy and society demand our curriculum and instructional practices to address? If there is a new, 21st century global digital economy, do we understand enough of its requirements to determine what schools must do differently from what they have done conventionally? As we search for effective practices and study ways to transmit what we've learned, are we trying to fit truly different kinds of goals, means and results into institutions formed to support other goals, means and results? Have we begun the process of understanding what our institutions need to become?

The introduction of ICT has in a mere seven years become a fundamental component of contemporary education. What it has not yet become is part of a construct of transformed public educational institutions. What we have discovered is that the implications of the 21st century global digital economy and the presence of ICT in our educational institutions has begun a dramatic process of change, not the least of which is that those exploring the possibilities are far more numerous and far more advanced than we may have thought. What we have not yet discovered is what we want to accomplish with ICT. What is not sufficient is to do the same things we've always done a little faster and a little better; the changes already in place tell us that such an ambition is too meager.

APPENDIX A: Meetings and Informants List

Type refers to Business Meeting, Presentation, or Reinventing Education Grant activity.

Multinational

Meeting/Group	Key Informant(s)	Dates	Type
BETT (British Education Training and Technology) Show	Multiple	1/13-1/15/99; 1/12-1/14/00; 1/10-1/13/01	P, B B B
OECD (Organisation for Economic Co-operation and Development)	David Istance, Principal Administrator, Centre for Educational Research and Innovation	7/5/99	B
EUN Schoolnet	Ulf Lunden, Director Ferry de Rijke, Chairman	1/11/00; 4/11/01	B B
EUN Schoolnet Conference	Ulf Lunden, Director	3/20-3/21/00	P
EU e-learning Summit	Multiple	12/7/00; 1/12/01 5/10/01	B B P

England

Business in the Community	Estelle Morris, Minister for School Standards	2/16/99	B
Lincolnshire Technical College		2/19/99	B
SEU (Standards and Effectiveness Unit), DfEE (Department for Education and Employment, now DfES, Department for Education and Skills)	Michael Barber, Director Ralph Tabberer, Senior Adviser	2/23/99	B
Birmingham LEA (Local Education Authority)	Doug Brown, IT Adviser and International Liaison	4/14/99	B
Staffordshire LEA		4/15/99	B
NGfL (National Grid for Learning), DfEE	Ralph Tabberer, Divisional Manager	4/19/99, 5/24/99, 6/29/99, 10/14/99	B G G G

Reinventing Education Project	Ralph Tabberer, Chief Executive, TTA Keith Andrews, Manager, Beacon Schools, DfEE	3/22/00, 9/29/00, 6/13/01; staff meetings 2000-present	B B B G
Essex County LEA	Peter Evans, Head of Education Services	4/21/99, 5/21/99	B B
BESA (British Educational Software Assn.)	Eileen Devonshire,	4/21/99, 6/29/00	B B
TWL (Tomorrow's World Live) Project meetings		4/20/99-6/27/99 multiple staff meetings	B
TWL Expo		6/28-7/4/99	B
NAHT (National Head Teachers' Association)	Chris Thatcher, President	5/24/99, 7/1/99, 9/15/99	B B B
BECTa (British Educational Communications and Technology agency)	Owen Lynch, Chief Executive; Fred Daly, Director, NGfL	6/14/99	B
Greenwich LEA		9/15/99, 11/15/99, 1/11/00	B B B
Skinners Conference		10/14/99	P
NAHT Conference	Chris Thatcher, President	10/15/99	P
DfEE	Michael Wills, Minister for Learning and Technology	11/17/99	B
DfEE, Curriculum and Communications Group	Imogen Wilde, Director of the Schools Directorate, DfEE	1/21/00; 1/8/01	B B
TCT (Technology College Trust)	Professor Nigel Paine, Chief Executive	3/15/00	B
Institute of London, Department of Education	Professor Geoff Whitty, Director	3/16/00, 1/8/01	B B
West Sussex Council		5/15/00	B
NAACE (National Association of Advisers for Computers in Education) Conference	Mike Smith, Professional Officer	5/16/00	P
TCT Conference	Professor Nigel Paine, Chief Executive	11/30/00	P
New Invention Infant School		12/4/00	G
Brychall Secondary School		12/4/00	G
NCSL (National College for School Leadership) Online	Tony Richardson, Head	12/7/00	B

Scotland

Inverclyde Council	Maria Russell, Director, Information Technology Services	2/17/99, 4/16/00	B B
Inverclyde Schools Head Teachers	Robert Cleary, Chief Executive, Inverclyde Council	4/16/00	P
SCET (Scottish Council for Education Technology)	Ian Watson, Managing Director; Richard Pietrasik, Chief Executive	5/28/99 7/4/99	P B
SESNET (Napier University)	Henry McLeish, Minister of Enterprise & Lifelong Learning	10/13/99	B
Glasgow Telecolleges Network	Tom Wilson, Principal	5/28/99, 11/19/99	B B
Scottish Executive	John Elvidge. Secretary and Head, Education Department;	4/16/99	B
Scottish Executive, ICT Team	Stuart Robertson, Team Leader	4/16/99, 11/19/99, 1/13/00	B B B
Clackmanonshire LEA		1/17/00	B
CBI Mentoring Project		3/23/00	B
British Association for Learning English for Academic Purposes (BALEAP) Conference		4/10/01	P
Edinburgh International Science Festival		4/12/01	P

N. Ireland

WELB (Western Education Library Board) Classroom2000	Jimmy Stewart, Director	6/12/01	B

Ireland

Reinventing Education Grant Project			G

Norway

Haram-modellen Schools	Arild Eiken, Project Leader	9/8/99	B

Denmark

Uni-C	Dorte Olesen, CEO	9/9/99	B
City of Naestved	Hermann Weidemann, Local Authority Director	9/99/99	B
City of Aarhus	Poul Tang, Sektornet Support	2/24/00	B

France

Ministry of Education	Pascal Colombani, Director of Technology; Clara Danon, Director of New Technologies	2/22/00, 7/5/99	B G
Toulouse IUFM and Academie	Gilbert Ducos, Director, Formation Unit	5/25/99	G
Toulouse ZEP Schools Project		1/12/00, 12/31/00 various remote meetings	G G

Germany

Berlin Senate Administration for Schools, Youth and Sport	Dr. Thoma, Media Consultant	3/13/00	G
Berlin Waldenburg-Oberschule	Herr Schwiewek, Headmaster	3/13/00	G
Reinventing Education Project Discussions	Herr Roland Berger, Director, e-initiative.nrw; Frau Dr. Susanne Pacher, Adviser, Baden-Wuerttemberg Ministry of Culture, Youth and Sport	5/19/00	G
Reinventing Education Discussions, Ministry for Schools and Further Training, Science and Research, North-Rhine Wesphalia	Paul Eschbach, Section Chief; Roland Berger, Director e-initiative.nrw	9/27/00, 1/11/01	G G

Italy

Reinventing Education Project			G

Singapore

Reinventing Education Discussions with MOE	Betsy Lim, Director of IT Training	1998-1999, multiple meetings	G
Outram School	Chan Poh Meng, Principal	8/28/99	B
Raffles Girls' School		8/30/99	B

Nanyang Girls High	Goh Kin Soon, Head of Department, IT	8/30/99	B
MOE	Wee Heng Tin, Director-General of Education; Tan Yap Kwang, Director Educational Technology Division; Betsy Lim	8/26/99, 9/2/99, 4/2/01	G G G
Schools' Administrators Plenary		9/2/99	P
Teacher's Network	Nicholas Tang, Deputy Director	8/28/00	B
Outram School/MOE Reinventing Education Project	Chan Poh Meng, Betsy Lim	3/7-3/11/00; 8/25/00; 3/30-4/2/01	G

Vietnam

Reinventing Education Project			G

Japan

Mitaka City Education Center		8/29/00	B
Reinventing Education Discussions	Katumi Oshima, Chief Researcher and Teacher-Consultant to Mitaka City Board of Education	8/31/00	G

Australia

Department of Queensland Education	W.G. (Bill) Clarke, Director, Information Management	8/22/00	B
Victoria Department of Education and Employment Training	Nicky Capponi, Manager, Centre for Technology Supported Learning	8/23/00, 3/28-3/29/01	G G

Mexico

Reinventing Education Project			G

Brazil

Reinventing Education Project			G

TOTALS:

BUSINESS	PRESENTATION	GRANT
62	10	28

APPENDIX B: IBM Reinventing Education Program

International Grant Site Overviews

Strengthening Curriculum

VIETNAM MINISTRY OF EDUCATION

Challenge: To improve the quality of instruction by providing teachers with hands-on professional development opportunities, with a focus on technology.

Technology Solution: Teaching and Learning with Computers

Current Implementation:

- Number of Schools: One primary school (Tran Quoc Toan), 4 secondary schools (Trung Nhi, Nguyen Truong To, Hanoi-Amsterdam and Chu Van An), and the Hanoi Teacher Training College (Truong Cao Dang Su Pham Ha Noi)
- Number of Teachers: 60 teachers

Project Description: The Vietnam Ministry of Education/IBM Reinventing Education grant partnership is focused on teacher professional development in the use of technology. Beginning in Hanoi, teachers are exploring and learning new ways of teaching and learning in order to improve students' performance using IBM's ***Teaching and Learning with Computers*** (TLC) approach, which emphasizes integrating technology into school curricula and student-centered classes. The partnership involves the Hanoi Teacher Training College, the major teacher training institution that has incorporated technology into its ongoing preservice program.

Next Steps: The partnership, through the Hanoi Teacher Training College, will continue to train greater numbers of teachers throughout Hanoi, beginning in Ho Chi Minh city.

Increasing Collaboration for Higher Achievement

IRELAND DEPARTMENT OF EDUCATION AND SCIENCE

Challenge: To bridge the gap between home, school and community by providing parents with secure, online opportunities to participate in their children's education.

Technology Solution: IBM Learning Village

Current Implementation:

- Areas of the country: Dublin, Cork and Dundalk
- Number of Teachers: 450

Project Description: Through Reinventing Education, a localised version of ***IBM Learning Village*** is being implemented in three areas of the country: Dublin, Cork and Dundalk. Teachers are using the technology to collaborate with teachers in other schools on subjects of common interest such as best practices in science teaching. Using IBM Learning Village, teachers also have created their own homepages that parents are accessing for information on classroom activities. Parents are using the technology to communicate with teachers about their children's progress. The National Center for Technology and Education, a primary partner in this project, has developed training and materials for teachers on IBM Learning Village and is providing ongoing support.

Next Steps: Project scale-up will begin in Dundalk to introduce the project to all schools in the town.

UNITED KINGDOM DEPARTMENT FOR EDUCATION AND EMPLOYMENT

Challenge: To develop models for the effective dissemination and sharing of successful practices where a significant aspect of the sharing is online.

Technology Solution: IBM Learning Village

Current Implementation:

- Number of Schools: 50 schools (25 Beacon schools and their 25 partner schools)

Project Description: Through Reinventing Education, ***IBM Learning Village*** is being customized to support the Department for Education and Employment's efforts to raise academic standards through the dissemination of successful practices. Specifically, the technology is being implemented both in the Beacon schools, a network of the United Kingdom's best performing schools that are engaging in a range of activities to share effective practices, and in the Beacon's partner schools, which have joined the partnership to help create models of effective dissemination and practice. Using the technology's online communications tools, teachers within the Beacon and partner schools are collaborating with one another to share best practices and, most importantly, to identify and spread the critical components of effective systemic change in a school—beyond individual lessons, projects, and special initiatives.

Next Steps: As part of the development of the models, the partnership is determining how IBM Learning Village can interface with the Department for Education and Employment's Standards Website, so that educators can take advantage of the Website's standards repository along with the powerful IBM Learning Village collaboration tools.

Improving Teaching

STATE OF RIO DE JANEIRO, BRAZIL DEPARTMENT OF EDUCATION

Challenge: To improve the quality of teaching, with a focus on the sciences.

Technology Solution: IBM Learning Village

Current Implementation:

- Teachers trained: 700

Project Description: The Reinventing Education grant project in the State of Rio de Janeiro, Brazil is using ***IBM Learning Village*** to support the professional development of teachers of biology, physics and chemistry—academic areas where there are a lack of teachers. Following a similar professional development model as in other international Reinventing Education sites, teachers participate in hands-on training and share teaching and learning experiences; IBM Learning Village is being implemented to provide teachers with the ability to communicate online for ongoing support and guidance. Seven-hundred, of the approximately 1,200, science teachers in the Rio metropolitan area have been trained on IBM Learning Village at four sites, located in both the city and outer areas to be accessible to all teachers.

Next Steps: In 2002, the project will expand to include mathematics and language arts teachers, with the goal of reaching an additional 5,000 teachers.

ITALY MINISTRY OF EDUCATION

Challenge: To improve the quality of teaching by providing teachers with hands-on learning experiences and follow-up support and guidance.

Technology Solution: IBM Learning Village

Current Implementation:

- District Sites: Benevento, Crema, and Pontedera
- Number of Schools: 9 (Each site has 3: one elementary, one middle, and one high)

Project Description: The Italy/IBM Reinventing Education project is focused on using ***IBM Learning Village*** as part of the Italian Ministry of Education's comprehensive plan for the development of technologies that enhance teaching and learning. The technology solution is the basis of a comprehensive teacher professional development model, which combines hands-on training with online support and follow-up. IBM Learning Village has been translated and customized to meet the needs of the Italian school system, with the support of the local teachers and administrators and the IBM teams in Italy and Hursley, UK. It has now been implemented in three district sites in different geographic areas (from North to South): Benevento, Crema, and Pontedera. In the first site, Benevento, the school district is working with IBM to design and implement a Didactic Service Center to support this initiative for all of its schools.

Next Steps: The partnership is now expanding the number of schools in each site. Because the Ministry of Education believes that this model is perfectly consistent with its overall strategy, it is encouraging the development of new projects using the IBM Learning Village technology.

SINGAPORE MINISTRY OF EDUCATION

Challenge: To facilitate the movement from lecture-based to student project-based instruction through the introduction of new assessment and instructional strategies.

Technology Solution: Authentic Assessment Tool and IBM Learning Village

Current Implementation:

- School: Outram Secondary School
- Number of Teachers: 70

Project Description: The Singapore/IBM Reinventing Education project is implementing the ***Authentic Assessment Tool*** and ***IBM Learning Village's*** additional functions as the country begins to challenge their traditional instructional and assessment practices, shifting from a lecture-based approach directed by teachers to a student project-based approach. One major focus of the partnership is to establish standards for creating and assessing project-based lessons, in line with the Ministry of Education's long-term goal of setting and using standards for better teaching, learning and assessment. As part of outreach efforts, presentations and professional development activities throughout Singapore and the Southeast Asia Region are under way, with Outram Secondary School serving as a model for replication.

Next Steps: As the partnership comes to a formal end this year, plans are being developed to continue to expand the project throughout Singapore, as well as the Southeast Asia Region.

MEXICO Instituto Tecnologico de Estudios Superiores de Monterrey

Challenge: To improve the quality of instruction by providing teachers with hands-on learning experiences and follow-up support and guidance, as well as online professional development opportunities.

Technology Solution: IBM Learning Village

Current Implementation:

- **Number of Teachers:** 25 lead faculty members, who have responsibility for training additional teachers and professors

Project Description: Since May 2000, the partnership has been implementing ***IBM Learning Village*** at the Instituto Tecnologico de Estudios Superiores de Monterrey (ITESM, also known as Monterrey Tech) to improve teacher training for elementary and secondary schools. The technology, which has been customized for the Spanish language, is facilitating both off- and online teacher professional development by providing an integrated set of communication and collaboration tools that overcome barriers associated with distance, time, and cost. IBM Learning Village will complement Monterrey Tech's current teacher training efforts, including Tec.com—their new distance learning program, as well as a major training program for elementary and secondary school teachers.

Next Steps: The partnership will complete the development of an online teacher training course that uses IBM Learning Village's Instructional Planner. The partnership also plans to expand the number of teachers involved in the project and to bring the Mexico Ministry of Education into the partnership to aid in the scale-up of the technology to more teachers.

VICTORIAN DEPARTMENT OF EDUCATION, EMPLOYMENT AND TRAINING

Challenge: To improve the quality of instruction by providing teachers with hands-on learning experiences and follow-up support and guidance.

Technology Solution: IBM Learning Village

Planned Implementation for Pilot Stage:

- **Number of Teachers:** 12 teachers from 6 different schools

Project Description: The partnership, launched in March 2001, will implement ***IBM Learning Village*** to enhance teacher professional development opportunities and student learning, particularly in the elementary and middle years. Specifically, the project will use IBM Learning Village's communication and collaboration tools to provide follow-up support for teachers participating in hands-on training opportunities. The project also will use IBM Learning Village's Instructional Planner to create standards-based lesson plans. Finally, the project will adapt the classroom-based teacher training models developed in San Jose, which focus on inquiry-based research projects that incorporate technology. To ensure successful expansion, the project is developing links with other Department initiatives, including the Successful Implementation of Learning Technologies (SILT), which is establishing baseline data about effective teaching and learning practices and is exploring mechanisms for facilitating teacher adaptation of these practices.

Next Steps: The project will be incorporated into the Department's Learning Technologies Professional Development Program in Victoria. The network of teachers and schools will expand progressively to 70-100 teachers in 24-36 schools over the period of the project, and in the ensuing years, these teachers will act as mentors, supporting the provide professional development of other teachers.

Building Awareness of Text Structure through Technology

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Text Structure Overview

Reading is defined as the ability "to get the literal or stated meaning from something read" and "to transmit meaning; to comprehend text by engaging in an interchange of ideas or a transaction between the reader and the text" (Harris & Hodges, Eds. 1995, p. 203). Historically, research has shown that a reader's recall of ideas from text is enhanced when the reader uses relations among concepts to organize information (Meyer, 1975,1979). Text structure is a term used to describe the various patterns of how concepts within text are related. Knowledge of text structures assist a reader to comprehend text by allowing the reader to anticipate information and by helping the reader infer information that may have been omitted by the author (Leu, D.J. & Kinzer, C.H., 1995). Burns, Roe & Ross (1999) state that it is important to attend to teaching text structure because knowledge of patterns of text organization has been shown to facilitate comprehension. Text structure may be considered a blueprint to help a reader build meaning from text.

Text may be organized in various ways depending on the purpose of the author. Components of narrative discourse, often referred to as story grammar, include "setting information, a problem, and episodes that describe attempts to resolve the problem. (Leu & Kinzer, 1995, p.157). Informational text, also known as expository writing may be identified by the way in which concepts are related within a text. Meyer (1979) examined the relations between ideas and identified four organizational patterns by which text is frequently structured. She described those four top-level expository text structures as: (a) response (problem/solution); (b) adversative (comparison/contrast); (c) covariance (cause/effect); and, (d) attribution (collection). Meyer and Freedle (1984) examined the structure itself to determine if some text patterns facilitate recall better than other structures of organization. They found that the more complex a top-level structure, the more likely it is to facilitate recall. Specifically, they examined four ways to organize text, collection, causation, problem/solution, and comparison, to determine if one text structure promoted better recall than others. Content was held constant, but structure was varied to represent each of the four structure types. Results indicated that adult subjects recall most from passages organized in comparison structure, followed by causation, problem/ solution, and collection/description in that order.

Wilkinson (1995) states that teachers should provide "insights into the ways in which a proficient language user operates" and encourage "students to be aware of their own processes."(p. 7). Several studies support teaching text structures in order to improve reader's recall of information presented in text (Alvermann, 1982, Berkowitz, 1986, Raphael and Kirschner, 1985). Presenting patterns of text organization through visual aids has been found to be effective. As early as 1983, Geva found that actively involving students in creating flowcharts that represent text content and structure in a graphic form assisted students in identifying and clarifying their understanding of relations among text elements. Visual representations of text structure help students develop an image of the organization of concepts. Vacca and Vacca (1999) report that, "graphic or visual representations help learners comprehend and retain *textually important information.*" (p. 400). They also state that,

> ... when students learn how to use and construct graphic representations, they are in control of a study strategy that allows them to identify what parts of a text are

> important, how the ideas and concepts encountered in the text are related, and where they can find specific information to support more important ideas (Vacca & Vacca, 1999, p. 400).

As research has indicated, teaching students to utilize organizational patterns in text facilitates their comprehension of text. Computer programs are available to assist in creating visual representations of text by providing a framework for teachers and students to arrange concepts and show how ideas are related.

Narrative Text

Story Grammar is usually the first text structure a young reader encounters. A story is described as a tale comprised of a plot, character(s), and setting. Harris and Hodges (1995) state that a plot describes the action of a story and is usually presented in three parts. Those three parts are "rising action, climax, and falling action leading to resolution or denouement" (p.189). The plot, which begins with an initiating event, usually involves a subsequent event or events describing how the character(s) responds to that event. Characters are the persons involved in the story. Setting includes the place and time in which the story occurs.

Teachers use visual representations of the key components of a story to illustrate these concepts. Story maps (Table 1), character maps (Table 2), and timelines (Table 3) are some of the more common formats used to visually represent components of a story. These visual representations are arrangements of frames that are created to prompt readers to record key ideas from the story being analyzed. Frames are connected to indicate how ideas are related. Arrows are used to connect ideas that occur in a sequence. Teachers can create these graphic representations on posters or chart paper for class-sized presentation. Smaller representations are made on sheets of paper for students to use in individual activities. These visual aids are often decorated with pictures and shapes that follow the theme of the story in order to build interest and cue students to expected information.

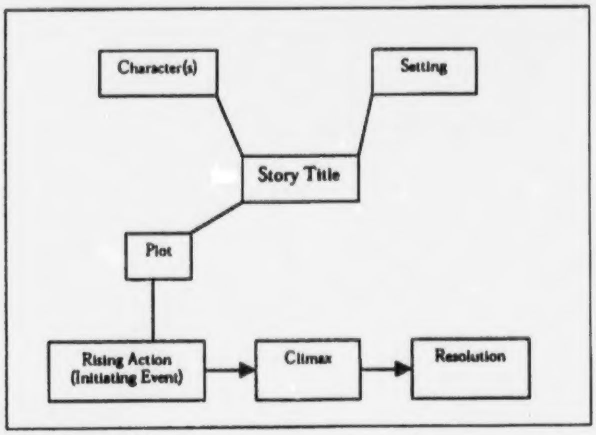

Table 1: Story Map

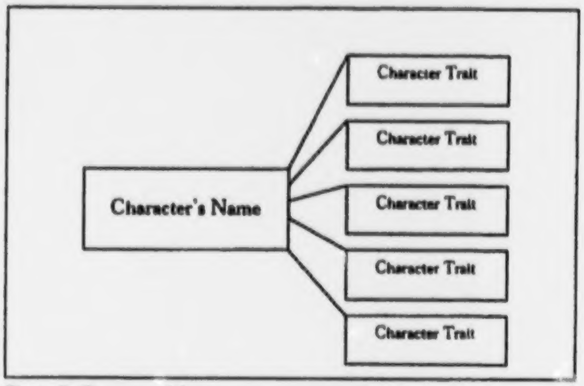

Table 2: Character Map

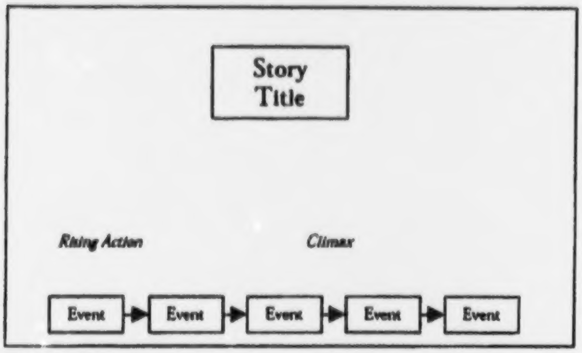

Table 3: Timeline

Story maps, character maps and other types of concept maps may be created through the use of technology. Two programs written to produce concept maps are Inspiration®, which is for middle school and older readers, and Kidspiration ®, which is for younger readers. Information is entered into frames that appear on the computer screen prompted by a mouse click. Links from one frame to the next are easily created or may be automatically inserted through the use of a function known as "rapid fire". Frames may be formatted into a variety of shapes through the use of the program's library of shapes. The frame shapes add emphasis and/or visual meaning to key ideas. Both programs work well in a small group or whole class setting when the visual display is presented through a large screen monitor or projected on a screen. Concept maps may be printed out for readers to work independently. Another feature of these two programs is that not only can the information be viewed as a concept map, but it can also be viewed as an outline. This feature helps readers make a connection between the graphic representation and its outline format. These two programs feature blank formats so the teacher can create a customized concept map and templates so the teacher may utilize a preset model for organizing story information. The templates may be customized, but they provide a good basis for beginning the creation of a new map. Timeliner® is a program that was created to facilitate the development of timelines. Information is entered in a table format and may be viewed as a table, an outline, or as a timeline. Additional frames may be added for titles and other information. Pictures and graphics may be inserted to customize timelines.

Expository Text

Readers encounter expository text when they are reading content area information. Exposition should be written so that concepts are stated clearly in a well-organized manner. Readence, Bean, and Baldwin (1998) state that "knowledge of text structure helps to guide students' comprehension of text." (148) Expository text structures can be represented visually in a variety of ways. Concept maps support comparison/contrast, cause/effect, and collection. Timelines help readers visualize sequenced information. Through the hierarchical outlining of information, such as graphic organizers, students identify key concepts as well as supporting detail and by grouping information according to common concepts, through concept maps, students learn about classification. Technology can facilitate creating these visual aids.

Time ordered and sequenced information can be represented through a timeline. Timeliner®, a previously described program, works as well for informational text as it does for narrative text. Presentation software such as KidPix® and Power Point® are also useful aids to help students visualize sequenced information. Presentation software allows information to be presented one screen at a time for viewing the information in order. A screen or slide can be moved if the information is re-ordered. Power Point® will show information either in slide view or in an outline view.

Building on the concept of sequenced events, readers learn that some events can cause other events to occur. Because the concept of cause and effect relation builds on the concept of events occurring in a sequence, Timeliner® provides a venue for creating a visual aid to support cause/effect text structure as well as simple sequence. Concepts in text that are related through cause and effect can be visualized through a concept map. Inspiration® and Kidspiration® both provide a format to represent this relation between concepts. Each program has a template to facilitate the creation of a cause and effect concept map. Frames in a concept map created through Inspiration® and Kidspiration® can be connected with an arrow instead of a simple line to indicate a cause related to its effect.

Classification and compare/contrast are text structures that may be represented through concept maps created with Inspiration® and Kidspiration®. There are templates to assist development of appropriate concept maps for each. For classification, ideas are linked with lines to indicate related concepts. A data base program such as Access® is another excellent tool to assist students' learning about classification. Information is listed in a table format and then may be sorted by attribute to assist a reader in classifying the information. Analysis of attributes not only helps students classify information, but compare and contrast it as well. Another visual aid to assist in comparing and contrasting information is the Venn diagram, which can be easily constructed using draw tools. Through the use of visual aids, related concepts become evident and readers can better comprehend and recall information. Whether the text structure is story grammar, cause/effect, compare/contrast, sequence, or classification, representing text structure visually provides a blueprint to help readers build meaning from text.

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Assessing an Untapped Supply of Information Technology Workers: Adult Women and Underrepresented Minorities

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Abstract

According to America's leading corporate chief executives, strengthening the technological workforce is the single greatest challenge facing our nation's ability to compete over the next decade (Council on Competitiveness, 1998). Women and underrepresented ethnic minorities have been identified as sorely underrepresented both in the information technology (IT) degree programs and in the workforce (Campbell, Denes, & Mottison, eds. 2000). Researchers have concentrated on increasing the number of K-12 female and minority students interested in, entering and graduating from IT programs in an effort to increase the numbers selecting IT careers. Reaping the fruits of this labor, however, takes approximately 20 years.

There is a large untapped underserved supply of potential IT workers, namely adult women and minorities that could immediately alleviate the growing shortage. The Census Bureau estimates that only 21% of all adults have a baccalaureate degree. Adult students (i.e., over 25 years), however, represent nearly 50% of all credit students in higher education (The College Board, 1998). Little to no research, however, has occurred on adult students let alone adult female and minority students enrolled in baccalaureate and master's IT programs (i.e., computer information systems, information technology and technology management). 10 to 15% of traditional four-year universities enrollment in IT programs is female and minorities. No one knows how many are adult students.

A significant number of adult women and minority students, however, have been enrolling in IT programs at the University of Phoenix for many years. Adult women comprise over 38% and minorities over 36% of the undergraduate information systems enrollments (i.e., average age is 33 years) (*Registration Survey*, 1999).

This study analyzed six unique student populations: graduates: recent and alumni; still enrolled; and not enrolled: stopped or dropped out, across two modalities (i.e., online and on ground) from 1995 to 2000. The following research questions were examined:

- What motivated them to enroll in an IT degree program?
- What university characteristics influenced their choice of institution?
- What facilitated their persistence and/or degree completion?
- What employment incentives enabled enrollment and degree completion?

The goal of this exploratory research was to obtain an understanding of the backgrounds, motivations, preferences and support systems that adult women and minority IT students express upon entrance and exit (i.e., completion or leaving) from the University of Phoenix. By exploring the motivations, preparation, choices, support systems, faculty attributes and perceptions that shape successful students. Colleges, universities and teacher education programs will learn how to encourage, enroll, educate and provide support services to adult female and minority IT students. This study should benefit institutions across the country with low adult participation rates and also increase the number enrolling and completing an IT degree. The number of traditional-age students selecting an IT degree program and career should also increase, as these successful adults will serve as role models to their children and to their communities.

Background

Trained technology professionals are critical to our nation's infrastructure. They are needed to create and develop new ideas, form talent pools for existing businesses and to launch new companies (President's Information Technology Advisory Committee Report to the President, February 1999). According to the Bureau of Labor Statistics (1997), the need for computer scientists, computer engineers and system analysts will double from 1996 to 2006. Even with the demise of a significant number of dot com businesses, it is estimated that 425,000 positions will go unfilled in 2001. The shortfall is projected to continue to increase (ITTA, 2001, p. 4).

According to the 2000 Census, the largest growing populations were the racial/minorities (i.e., American Indians, Asians, Blacks and Hispanics). They constitute about one-fourth of the total U.S. workforce, 30% of the college-age population, and a third of the birth rate, yet comprise only 6.7% of the U.S. computer and information science labor force. The Department of Commerce reported that in 1996 women made up 30% of the IT workforce, Blacks 5% and Hispanics less than 5%. The growing shortage of IT workers will worsen unless more women and they minority groups enter the IT field (Foster, 2000).

There is, however, a large increasing, population of adults (over 25 years) returning to higher education for purposes of obtaining a degree, re-careering and retraining (Kim, 1999). While 82.8% of all Americans, 25 years and older, have obtained a high school diploma/GED, only one-quarter have earned a baccalaureate degree (22.4% of women; 14.7% of Blacks; and 11% of Hispanics). While over 54 million adults have received some formal training from employers in the past year, studies have shown that professionals and managers receive the majority of training. Younger, male and white employees receive more training than older workers, women, and other ethnic employees (Merriam, 2000).

America's workers believe that "higher education is the ticket to the middle class." More than 60% of parents of high school students see a college education as "absolutely necessary." When asked to choose the single factor that most determines success, 67% of Hispanic parents and 45% of African-American parents picked a college education, compared with 35% of parents over all. Almost two-thirds (64%) of workers believe that the primary purpose of a college education is to prepare students for specific careers. (Heldrich Work Trends Survey, June 2000). When asked to choose the single factor that most determine success, 67% of Hispanic parents and 45% of African-American parents picked a college education, compared with 35% of parents overall. "A college education has become as important as a high school diploma used to be" (Wilgoren, 2000).

Adults see the need for higher education. Since the 1970's their participation in education has gone up significantly (Kim, 1999). While data is not available on the number of adults enrolled in IT programs across the country, data from the nation's largest private university shows that significant (and increasing) numbers of adult women and minority students are entering IT programs.

Few to no studies have examined adult students participation in postsecondary IT programs. Most of the research has centered on K- through traditional-age college students. This study provided a unique opportunity to study adult participation in higher education and more specifically, in information technology degree programs. By exploring and understanding why adult females and minority students select an IT academic program to re-career into mid-life and learning what contributes to their successful degree completion, institutions of higher education will learn how to motivate, encourage and support a vast underserved number of potential adult students.

Objectives

The goal of this exploratory research was to obtain the primary reason why adult women and minorities decide to enter an information technology degree program (i.e., undergraduate and graduate, online) and on ground) and to learn about their backgrounds (preparation and family support), motivations, support systems, preferences (i.e., faculty and student support services) and to determine the success factors that contributed to degree completion.

This study analyzed six unique student populations (i.e., graduates: recent and alumni; still enrolled; and not enrolled: stopped or dropped out) across two modalities (i.e., online and on ground) from 1995 to 2000. The following research questions were examined:

- What motivated them to enroll in an IT degree program (i.e., background characteristics, role models, academic preparation, first exposure to technology, career issues, previous educational experiences, etc.)?
- What university characteristics influenced their choice of institution (i.e., education goals, expert faculty, availability of program, online courses, contextual learning, support services, location, peer interactions, recommendations of employer, reputation, etc.)?
- What facilitated their persistence and/or degree completion (i.e., mentors, support systems—personal, financial and educational, motivation to persist, perceived and actual barriers, etc.)?
- What employment incentives enabled enrollment and degree completion (i.e., managerial support, tuition reimbursements, upward mobility, promotion, financial rewards, etc.).

The goal of this exploratory research was to obtain an understanding of the backgrounds, motivations, preferences and support systems that adult women and minority IT students express upon entrance and exit (i.e., completion or leaving) from the University of Phoenix.

Study University

The study university was the University of Phoenix, created in 1976, by Dr. John Sperling. The mission is to provide high quality education to working adults whose access to higher education is limited. Dr. Sperling determined, as documented by Kasworm, Sandmann & Sissel 2000, that adult students were marginalized, if not invisible, in a system where all aspects of support and curriculum favor the traditional-aged student. Adult students participate at the periphery in traditional universities. Many adults cannot participate unless they are unemployed, as the majority of courses are only offered during the day.

Since family and work responsibilities cause time limitation problems (the number one barrier adults have given), the curriculum was created and organized (lock-step) so that working adults focus their limited time on one course at a time. This method facilitates the "learning builds" philosophy. Initially, the curriculum was limited to programs most important to working adults (i.e., undergraduate and graduate business programs). Dr. Sperling created an integrated model that affords adult students a quality education at convenient locations and times.

Classes at the University of Phoenix begin at 6:00 p.m. and last for four hours one day a week for five weeks at the undergraduate level and six weeks at the graduate level. Each course has a required learning team component where small groups of students are required to meet each week to mutually research a topic beneficial to the group, write a research paper and if time permits present the outcomes to the class. Many courses require both multiple individual and study group outcomes.

Additional academic programs in counseling, education, nursing, and technology were added in the 1990's when the need and demand for them became apparent. More recently programs in Justice Studies, Human Services and a Doctorate in Leadership Management have been added.

Initially, to gain admission to the university, students had to have completed 60 hours of postsecondary credit and be full-time employed. This criterion was changed in late 1994 to meet the need of military students. Now a student must be 23 years of age, working, and have a high school diploma. Currently, if a student does not have 24 hours of accumulated lower-division credit, he/she must enroll in the Introductory Course Sequence program. Upon successful completion of this program, he/she can apply to a specific academic degree program.

Support services also custom designed to meet the needs of working adult students. Once the student decides which day of the week to attend, his/her academic counselor enrolls the student for all of the sequenced courses in the respective academic program. Students know their graduation date on the first day of class. Class sizes are kept small (12 to 15 on average on-ground and 8 to 10 students on average online) so that all questions can be answered and the curriculum can be thoroughly digested. Classes begin every day of the week (except Sunday) and every week of the year (except Christmas week). If changes need to occur, the student's personal academic counselor handles all scheduling changes. Books, modules, and supplemental reading materials are mailed and/or obtained via a web site. Course schedules and grades are posted on the web, for secure access by students. An online library provides timely, up-to-date library materials for all students. Library agreements have been negotiated with on-ground public libraries to provide additional resource materials.

The University currently enrolls over 94,000 students in 34 geographically large and diverse cities across 19 states, Puerto Rico and Vancouver, British Columbia. Almost one-quarter of the students are enrolled in the Online campus.

Online Campus

In 1989, the Online Campus was an outgrowth of the University's mission to serve adult learners by providing a variety of academic options and opportunities. It was also a response to increased demand by traveling professionals who were unable to stay in one spot for any length of time. The Online campus allowed them to complete their degree: any time, any place in the world. Other professionals who did not have access to higher education also had an opportunity to complete their degrees.

Initial research and development focused on selecting a technology (i.e., asynchronous) that would preserve the interactive qualities of the learning model already in existence in on-ground facilities. It was equally important that the technology be commonly available and easy to operate. Computer conferencing met both criteria and enabled an open environment that allowed students to use any kind of computer and modem.

Online students and faculty received training on how to operate the system. not only receive regular faculty training but additional training on teaching in the online environment. Both students and faculty receive 7-day, 24-hour technological support. The online course completion rate is 95% and the graduation rate is 65%. The learning outcomes for online students are also higher than for on-ground students but this may be due to a higher ability level student selecting the Online campus.

Faculty

The faculty are also working professional adults. They must have at least a graduate degree from a regionally accredited institution earned a minimum of two years prior to their application to teach. Their degree must be in the area in which they will be teaching. Faculty must have a minimum of five years of significantly responsible, current experience on the job in the same area in which they will be teaching. The practitioner faculty ensures that the curriculum is up-to-date and accurate as they are the content experts (i.e., understanding from first-hand experience). Similar time constraints that working adult students endure are also endured by the faculty.

Before a faculty member is hired, he/she must pass an extensive screening process. If they pass the screening process, they then must pass the training sessions. Faculty are taught how to teach to adult students. They go to class just like students in the evening and receive extensive training in several areas (i.e., Adult Learning Theory, facilitative methods, contextual learning, diversity, ethics, assessment, feedback methods, grading, etc.). Once they successfully complete their training (i.e., 6 to 8 weeks), they are formally hired to teach a course. Generally, faculty are only certified to teach one to two courses. Their first teaching assignment is conducted with a seasoned mentor faculty member in attendance. The mentor stays in the background throughout the entire first course and gives feedback to the new faculty member (i.e., teaching tips).

Faculty must attend several professional development workshops and seminars annually to remain active. Additionally, faculty receive student evaluations at end of all courses (i.e., Student End of Course Survey). Administrative reviews (i.e., the Director of Academic Affairs and the Curriculum Chair) are performed twice a year in the classroom. All assessments are done to improve and enhance the faculty member's teaching skills. If a faculty is found to be deficient in an area, he/she is scheduled to attend a professional development course on that particular deficiency. Most faculty welcome the assessment feedback. They want to know that they are doing a good job of teaching.

Faculty must teach to the mandated course outcomes as these are the outcomes students will be assessed on at the end of their academic program. Faculty may embellish (i.e., add to) the curriculum, but they cannot eliminate or change the required elements. By mandating the same outcomes in all identical courses, the University can determine which campuses and modalities are more effective. Any change to the curriculum can also be measured against the standard set. The University knows whether a change will increase and/or decrease student learning.

Assessment

Assessment of all educational activities and processes occurs daily. The University has an extensive award-winning assessment program comprised of two systems: The Adult Learning Outcomes Assessment (ALOA) and the Academic Quality Management System (AQMS). The ALOA system is comprised of a series of cognitive (i.e., academic program outcomes, mathematics and English), affective (professional and educational values), communication (written and verbal) and critical thinking assessments. The assess-ments must be taken at entrance into an academic and upon completion of the student's academic program (i.e., required for graduation).

The AQMS system is comprised of a series of surveys to measure institutional effectiveness. All students and faculty must complete an end-of-course survey for every course taken and taught. The end-of-course surveys provide evaluations of the curriculum, the textbooks and materials, the adequacy of the online library, the faculty member's skills and abilities (faculty evaluate student preparation, participation, etc.), the study groups/learning teams, and support services (i.e., staff and administration, financial aid, parking, facilities, etc.). The outcomes of these surveys are analyzed immediately and given back to the campus Director of Academic Affairs. The faculty member also receives a summary after grades are posted. The timeliness of the feedback to the campus and to the faculty member means that improvements, if needed, can be accomplished immediately.

Student Demographics

The average on-ground undergraduate student is 34.7 years of age, is female (57%), married, has two children, 13.6 years of business experience, earns $61,000 a year, seeks a business degree and has previously attended three to four higher education institutions. 93% of the students bring previous academic credit with them. 4 to 5% have earned a degree. Over 40% of the students are first-generation students and 42% are from a minority group (1% American Indian, 4% Asian, 13% Black, 1% Native Hawaiian, 1% Pacific Islander, and 22% Hispanic) (University of Phoenix *Fact Book*, 1999). 65% plan to pursue graduate education and 25% of the graduate students plan to earn a doctoral degree. Graduate students are older (36 years); and are in higher level positions of authority (25% executive/manager/administrator compared to 20% for undergraduates).

Until the technology programs were offered online, the average Online student was older (36 years), male (65%), White (81%), in a graduate business program (MBA) and employed in a higher level position (69% executive/manager/ administrator). With the advent of the technology programs the demographics of the Online campus are shifting to resemble on-ground students: average undergrad is female 55% with an average income of $75,000, 37.5% are first-generation, 90% have attended another higher education institution. The average Online graduate student is male 82%, age 36.8 years, and earning $85,000. The average Technology student is male 67%, age 34 years, married, income $66,000. 30% of the BSIT students work as technicians for an IT company, 65% planned to obtain a graduate degree.

Academic Programs

Not all of the 34 major campuses and over 128 learning centers offer all academic programs. The programs offered are based on the needs of the local community. IT programs are offered in the following locations: Arizona (Phoenix and Tucson) California (San Diego, San Jose, Los Angeles area, Sacramento), Colorado (Denver and Colorado Springs), Florida (Tampa, Orlando, Ft. Lauderdale, Jacksonville), Hawaii (Honolulu), Louisiana (New Orleans), Maryland (Baltimore), Michigan (Detroit and Grand Rapids), Nevada (Las Vegas), New Mexico (Albuquerque), Ohio (Cleveland), Oklahoma (Oklahoma City and Tulsa), Oregon (Portland), Pennsylvania (Philadelphia), Utah (Salt Lake City), and Washington (Seattle). IT enrollments in the Online Campus (enrollments in all states and 22 countries around the world, Vancouver, British Columbia, and San Juan, Puerto Rico campus were also included.

The IT programs are administered by the College of Information Systems and Technology, within the John Sperling School of Business. The IT programs at the undergraduate level are:

Bachelor of Science in Business/ Information Sciences (initiated 6/1994): The BSB/IS is designed to enable graduates to deal effectively with information technology components that have become an integral part of today's increasingly complex business environment. The program stresses skill development in the technical areas of computer hardware and software architecture, file and data structures, systems analysis and design, programming, software engineering, telecommunications, and management of the information systems function. Each student completes a major project in an information systems area that is related to his or her professional responsibilities and that demonstrates the ability to integrate a variety of business and technical skills in the solution of a problem. The IT courses provide a solid grounding in each of the components of integrated information systems. By combining business and information technology, students develop the ability to apply the tools and techniques of information technology to meeting the goals and objectives of business.

Bachelor of Science/Information Technology (initiated 10/1998): The BSIT program focuses on the acquisition, deployment and management of information technology resources and services, as well as the development and evolution of technology infrastructures and systems for use in organization processes. There are five specialties: Web Management, Database Management, Business Systems Analysis, Networks and Telecommunications, Programming and Operating Systems. The core courses provide fundamental knowledge and practice in both the information technology function and in system development. The specialty courses of the program are extensions in breadth and depth of the technology core courses and enable the student to choose one or more areas of special expertise in an IT area. The curriculum is designed to produce graduates ready to function in information technology positions with the competencies, skills and attitudes necessary for success in the workplace and forms the basis for continued career growth, lifelong learning as an IT professional or in a future graduate program. The coursework is in keeping with the curriculum guidelines set forth by the Association for Computing Machinery (ACM), the Association for Information Systems (AIS) and the Association for Information Technology Professionals (AITP) in "IS '97, Model Curriculum and Guidelines for Undergraduate Degree Programs in Information Systems."

Bachelor of Science in Business/E-Business (initiated 2/2000): The BSB/EB blends business and information technology to address the emerging field of e-Commerce and e-Business. The program provides fundamental knowledge and application in both business and information technology. Coursework includes management, organizational behavior, critical thinking, research and evaluation, financial analysis, and marketing along with business system development, project planning, operating systems, programming, databases, networks, and telecommunications, the Internet, Web and e-business. The curriculum is designed to produce graduates ready to function in e-Business positions.

IT programs at the Master's level are:

Master of Science in Computer Information Systems (initiated 9/1992): The MSCIS is designed for students who wish to integrate the different disciplines of information technology in a business applications context from a management perspective. Courses cover the key concepts of information technology, information systems management and interpersonal and organizational communications.

Master of Business Administration/Technology Management (initiated 8/1994): Students who enter the MBA/TM program are working professionals who have responsibilities in a wide variety of technical, business, management, and support functions of the technology-based enterprise. The importance of management in a technical environment is a core concept. "Technical" is defined much broader than computer information systems and technology; it includes engineering, pharmaceutical, chemical, and other technical areas. The program is dedicated to the linkage of technical and business cultures as integrated functions of the technology-based organization and to the creation and maintenance of an innovative environment for the management of change throughout the creation to application of technology development.

Study Population

The study population included all female students and minority male students in the IT programs enrolled from January 1, 1995, through August 31, 2000. Initially, this number was reported to be over 8,500 females and over 8,900 underrepresented minority students. While this number was quite substantial, in January 2001, the IT department informed the principal investigator that over 33,000 students were inadvertently omitted from the initial dataset. This was not a random error. The total dataset included white males and once they were removed and the racial/ethnic characteristics were determined the total population numbered over 21,000 students [See Table 1.).

Methods

The initial population to be studied numbered 15,000+ students. In January 2001, the information technology department informed this researcher that they found an error in the programming. The total study population was closer to 48,000+ students. The error was not random ergo a sampling procedure could not be done.

Due to a change in the student information systems, the majority of racial/ethnic descriptions are contained in a separate database. It was necessary to cross this database with the new extract from the new student information system. This process was a quite time consuming. There was not a unique list of racial/ethnic identifiers. Over 175 different racial/ethnic codes were used for the majority of students. It took close to two months to determine the population (N=21,745) for this study.

Since the size of the population increased significantly, the planned procedure (i.e., use of scanning surveys for on-ground students and an e-mail/web survey for online students) was too costly. The most cost efficient method was to conduct an e-mail/web survey for all students. The IT department obtained all e-mail addresses (i.e., good and obsolete e-mail addresses from an older in-house conferencing system) in the student information systems (many unusable e-mail addresses). Regular mail addresses were obtained for the subset with no e-mail addresses. A letter from the President requesting the non-e-mail students go to a web site was created. A unique ID and password was inserted into each letter so that students could enter a secure web site and take the survey. The initial mail-out of e-mails and the letters occurred in June 2001.

This paper presents the first wave of student responses and is NOT representative of the greater population but does give some interesting findings.

Student Populations

Six different populations comprised the study of adult woman and minorities enrolled in an IT programs at University of Phoenix from 1/01/1995 to 8/31/2000. They are displayed in Table 1.

Table 1. Study Population: IT Enrollments 1//01/95 to 8/31/2000

Female: White & Minorities	ONLINE		ON-GROUND	
	Undergraduate & Graduate		Undergraduate & Graduate	
	Female	Male	Female	Male
Graduated	1,176	675	273	256
Still Enrolled	5,733	3098	2,413	752
Not Enrolled	3,946	1,245	1,835	454
Total Modality	15873		5,872	
TOTAL	21,745			

NOTE: Not Enrolled contains students who have temporarily stopped as well as dropped out. Since the University operates on a daily basis (continuous enrollment and graduation), many students stop-out for short periods of time (i.e., work, vacations, health, family, etc.).

Methodology

This research used survey methodology. Use of surveys is the most efficient way to obtain a large number of responses on background characteristics, motivations, choices, etc., on a large broad representation of gender and racial/ethnic populations across a wide geographical area. The cost to obtain this volume of data using other techniques would be prohibitive. Time factors also prohibited other methods.

The questions on the three unique surveys (i.e., graduated, still enrolled and not enrolled) were comprised of items from national surveys as well as questions derived from an advisory committee of senior faculty and the Dean of the School of Information Technology. The national surveys used were:

Faces of the Future from ACT and the American Association of Community Colleges. The community colleges have also experienced increasing enrollments of their adult students as well as an increase in the number of students selecting an IT field. Areas that are covered on this questionnaire that was recently used on more than 100,000 community college students are: General Background (gender, race/ethnic, native language, income and personal education finances, parental education level, broad based life goals); Employment Background (current employment status, occupational field, employer compensation for education); Educational Experiences (highest academic degree earned to date, current academic effort, other academic institutions attended, academic goals, relationship between college attendance, course taking and employment); Current College Experiences (reasons for attending this college, satisfaction with the college, impression of the campus climate, areas of growth while at college.

1999 National Household Education Survey from the U.S. Department of Education, National Center for Education Statistics. This survey has been conducted since 1991 on adult participants engaged in some for of instruction or educational activity to acquire the knowledge, information, and skills necessary to succeed in the workforce, learn basic skills, earn credentials, or otherwise enrich their lives. The NHES begins with a screening of a representative sample of households. Because of high costs associated with screening large numbers of households, more than one survey is addressed concurrently. 6,977 interviews were conducted in both English and Spanish on the following areas: Initial background, English as a second language, basic skills and GED preparation, credential, apprenticeship, career or job related activities, other formal structured activities, computer-only or interactive video-only instruction, remaining background, and household characteristics.

Registration Survey (1995-2000), University of Phoenix. Registration data on the over 13,000 women and minorities that entered an IT program from 1/1995 to 8/31/2000 was obtained in the following areas: Decisions to attend a particular university, major personal and professional goals, job title, occupational area, financing education, owning a personal computer, perceived obstacles, years of full-time employment, race/ethnicity, age at enrollment, gender, annual salary, and annual household salary.

Exit Survey (1999), University of Phoenix. An exit survey on Phoenix and Southern California students was conducted in 1999. The areas covered were: Reasons for either stopping or dropping out (personal, employment, finances and academic).

Alumni Survey (1998), University of Phoenix. Over 8,000 graduates in 1997 and 1998 were surveyed using a telephone card as incentive. The following areas were surveyed: Age, race/ethnicity, gender, number of dependents, annual salary, internet access, current employment status, current academic status, plans for future education, occupation, job title, name of employer, years with this employer, level of responsibility, number of job changes, rating of education in preparation of over 25 areas (professional knowledge, critical thinking, management skills, etc.), comparisons to other educational institutions attended, study group experience, rating of the quality of 12 campus services, obstacles to degree completion, and financing of education.

These instruments were scrutinized by an advisory committee to determine the number of items from the national surveys and from local surveys that were included in the three unique surveys. Particular attention was made to ensure that the questions lead to appropriate comparisons to national populations.

A sixty-minute telephone card was used as an incentive for students who completed their surveys. The telephone card was mailed out upon receipt of the survey. This incentive has proven effective with adult students in a previous survey (i.e., Alumni Survey had a 40% response rate).

Preliminary Responses

Due to the short survey response period, the responses received to date are NOT statistically representative of the greater population but given here to initiate a discussion. Caution must be used when interpreting the preliminary results.

Still Enrolled:

- 66% are female, average age 41 years, 33% of the females are from a racial/ethnic minority group; while 50% of the males are Hispanic and 50% are Black.
- Females reported earning $26,666 on average but their reported household income was over $100,000. Males reported earning $50,000 with an average household income of $70,000.
- Males reported 2.6 dependents while females reported 1.6 dependents
- None of the females reported being the first generation in their family to enroll in higher education, but 33% of the females stated they were the first in their family to be in a technology field. Caucasian and Asian females were more likely to have parents with

a college degree. 100% of the males reported to be the first in higher education and in a technology field.

- All reported that English was their first language and that they spoke and wrote fluent English.
- Men reported using a computer for the first time at an earlier age than women (22 years on average versus 26 years).
- First used a computer:
  50% reported first using a computer at work; 33% at school; and 17% at home.
- First use of a computer:
  60% reported using a computer for word processing and playing games; 40% for programming; 20% for e-mail, homework and doing mathematics. Men reported using a computer in the early 1980's, while women were more recent to computer usage (i.e., after 1995).
- 60% reported not being interested in computers or technology in high school; 20% were somewhat to very interested.
- The highest rank skill leaving high school was speaking English; the next was critical thinking; followed by a tie between English writing and creativity.
- The number one ranked response for "what was the primary motivator for selecting a technology field" was "myself" followed by a family member and employer.
- 100% went directly to higher education after high school (60% to a community college and 40% to a 4-year university). The majority of minority students went to a community college first. 60% reported that technology was not their academic major.
- The average number of postsecondary institutions attended was two. 80% reported attending four or more semesters (60% reported accumulating up to 60 credit hours). 40% had received an AA degree and/or accumulated credit while 20% reported receiving a certificate.
- 75% owned their own computers while 25% reported having access either through work of another family member.
- Over 90% reported having an opportunity to complete a degree at a convenient time in a reasonable period of time while working full-time.
- 60% were planning on changing their career once they obtained their diploma; while 40% wanted to be promoted. They all indicated wanted a salary increase and that this was a benefit for their personal development.
- Prior to enrolling, the majority rated themselves as:
  - advanced to expert in accessing the web and using e-mail
  - advanced with word processing
  - intermediate with PowerPoint
  - no skills with spreadsheet
- 80% reported having full tuition reimbursement from their employer while 20% were using their own funds to finance their education.

- Learning teams ratings were exceptional high from all responders (i.e., equal participation; supportive atmosphere; accepting; members skills and abilities) but the majority stated there were not enough women and too few minorities.
- 60% were for an IT company; 20% for a financial business; and 20% in manufacturing.
- 20% worked as technicians, in engineering; in administrative; in administrative support; and 10% in communication and state and local government.
- The average length of employment was 11.25 years and 7 years on the current job.
- 80% reported that their degree program was not related to their current job.

Open-ended responses requesting information on how to improve or better assist women and minorities were most telling:

> "I think this field is perceived as too geeky or too difficult." (female)
>
> "Men in groups should not place unreasonable expectations on the women with less experience with computers." (female)
>
> "It is a great field to work in. (male)
>
> "There might be more opportunities to telecommute, have more flexible hours, which is my motivation." (male)

There were no responses received to date from the not enrolled students and too few graduate responses to include at this time.

Conclusion

The total results of this study should be available by October 2001. The final report will be distributed to those in attendance.

Knowledge of what contributes to motivate adult females and underrepresented minorities to obtain an IT degree and what factors enable the successful completion of an IT degree should provide administrators, provosts, deans (i.e., technology and education) and faculty and faculty training programs across the country with tools that can increase the number accessing, persisting and graduating. Knowledge of the barriers that inhibit and discourage successful completion of IT degrees will also be beneficial. By cultivating and increasing the number of adult women and minority IT diploma-seekers today through the narrowing of the gender and ethnic education gap, new IT leaders will be available within one to five years. This contrasts to waiting 20 years for the fruition of programs aimed at increasing the number of K-12 students entering the IT workforce. Employers may also benefit, if tuition reimbursements and supervisor support prove to provide support needed by women and minorities. America's workers want more than access to technology, they want to tap opportunities generated by the high-tech workplace and ensure that their children and grandchildren have the opportunity to do so (Heldrich Work Trends Survey, February 2000).

If the ethnic and gender education gap is to be narrowed substantially and rapidly, major efforts will be required from universities, families, communities, and from the private and public sectors at all levels (The Council of Economic Advisors, 2000). Changing deep-seated inequalities is a gradual process. Technology-delivered programs hold great potential for addressing inequalities.

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Constructionism as a High-Tech Intervention Strategy for At-Risk Learners

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Abstract

While much has been written about the theoretical basis for constructionism attempted in more traditional school settings, the Constructionist Learning Laboratory at the Maine Youth Center offers the first opportunity to document a full-scale implementation of constructionism in an computationally rich alternative-learning environment built and directed by Seymour Papert. This paper shares examples of work done by severely at-risk students and offers a context for thinking about alternative-learning environments in the digital age.

Research Setting

In 1999, Maine Governor Angus King Jr. asked Seymour Papert to develop a model of what learning might look like in the future. Papert's forty years of work with children and computing, as well as the historic impact information technology is having on society, requires that this vision for the future of learning would involve computers.

The result of the collaboration between the State of Maine and the Seymour Papert Institute was the creation of the Constructionist Learning Laboratory (CLL) at the Maine Youth Center (MYC). The MYC is the state facility for adjudicated youth. Approximately 230 residents, ages 11-21, are detained at the Youth Center for a wide range of offenses. The majority of the residents are detained for weeks or months, others years. The traditional high school at the MYC is challenged by low student motivation, poor literacy levels, negative school experiences, a high number of students classified as being learning disabled and a rigid cumulative high school curriculum that takes little notice of the transient student population.

The CLL is an alternative-learning environment, created within the grounds of the MYC. The Governor and State Commissioner of Education recognized the futility of teaching children with a long history of school failure in the same unsuccessful ways.

The intent of the CLL is to create a rich constructionist learning environment in which severely at-risk students are engaged in long-term projects based on personal interest, expertise and experience. Students use computational technologies, programmable LEGO and more traditional materials to construct knowledge through the act of constructing personally meaningful projects.

The CLL differs from traditional secondary schools in that it is:

- Multi-aged

- Self-contained
- Interdisciplinary
- Computer-rich
- Learner-centered

While some efforts at school reform have embraced one or two of the ideas mentioned above, few public schools have attempted to eliminate age segregation and compartmentalized curricula while supporting project-based learning, reflective practice and ubiquitous computing simultaneously. The CLL combines the theory of constructionism with powerful ideas from the school reform movement.

Each CLL student has a personal computer and access to a variety of materials. Students are expected to engage in personal and collaborative learning projects in which they construct knowledge, often by making something tangible. Some student artifacts have included a variety of robots, video games, plays, poetry, claymation movies, hand-crafted wooden guitars, ultra-light gliders, digital films. The students enjoy access to an extensive classroom library and constructive material including programmable LEGO.

The projects connect student interests and experience with powerful ideas through aspects of the engineering process—tinkering, prototyping, testing, building, debugging and the presentation of a finished product. The teacher's role is to support the students in the construction of their projects and help learners make explicit connections to the important scientific, mathematical, historical or artistic ideas implicit in their work.

In his most recent book, *The Connected Family* (1996), Papert states, "nothing beautiful is forced." The CLL strives to create an environment in which young people are engaged constructively, but without the coercion so often associated with traditional curricula. The absence of a bell schedule, tests and artificially segregated subject-area classes allows students to make connections between disciplines. They can work in depth on personally meaningful projects without the disruptions associated with high-stakes testing or competition fostered by traditional schooling. Students have the time to make mistakes, redefine their goals and develop the technological fluency required for realizing their objectives. Reflective practice is an important part of this learning process. Students are encouraged to document their own learning through personal portfolios, sketches, photography, videotape and contributions to the class' newsletter. The social culture of the CLL values collaboration, idea sharing and a sense of community. These skills are critical for a successful life, but may have been rarely experienced by the teens in the Youth Center.

A full-time teacher and a 'special projects leader' work with the students on a daily basis while volunteers and experts are brought in to lead occasional week-long immersive workshops. Students have already enjoyed such intensive workshops in drama, film-making, African drumming, electronics, radio journalism, career preparation and video game design. Skills and insights gained during these residencies are then used by students in their personal projects. Visitors also play a critical role in the professional development and continuous inspiration of the full-time teachers. Regular impromptu visitor "demos" provide opportunities for students to exhibit and explain their learning.

Brief mini-tutorials might be organized to teach specific MicroWorlds Pro programming concepts or explain scientific principles. Such instruction is designed to assist students in developing their own technological fluency in service of the development of increasingly sophisticated projects. As a result, students are able to express themselves and their ideas through a rich array of tools, strategies and media. The CLL has allowed many children to feel intellectually powerful and creatively expressive for perhaps the first time in their lives. A desk similar to the one pictured in Figure 1 might be found in the office of a great scientist or noted intellectual. This desk belongs to a CLL student misclassified by the traditional school system as illiterate.

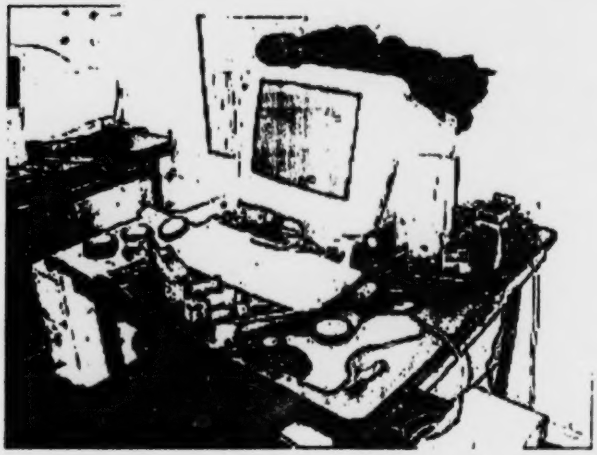

Figure 1

In the CLL the personal computer is truly personal. All students have their own and use them as a medium for constructing new things, a portfolio for keeping track of their own progress, an intellectual laboratory and a vehicle for self expression. Students program in MicroWorlds Pro, control robots with Yellow Brick Logo, edit video, publish newsletters and document their learning processes via the computer.

Computing in the CLL differs from many of the fads and fetishes associated with educational computing. Children use computers to build interesting things, document processes, experiment, tinker and share newly constructed knowledge. CLL students are active knowledge workers rather than passive recipients of content produced by others. The emphasis is neither on computer literacy or web surfing.

Theoretical Background

Constructionism

Constructivist learning theory is associated with the work of Jean Piaget and Lev Vygotsky. Constructivists argue that knowledge is not transmitted, but constructed. Each individual must reconstruct knowledge and this learning process happens within a material environment, a culture and a supportive community of practice. While constructivism defines learning as the building of knowledge structures inside of one's head, *constructionism* suggests that the best way to ensure that such intellectual structures form is through the active construction of something outside of one's head, that is something tangible, something shareable.

Where constructivism could be simply expressed as learning by doing, constructionism is learning by making. However, Papert's play-on-words is a deliberate attempt to both extend the notion of constructivism and offer a critique of its misuse in thinking about schooling. Papert is critical of how constructivism may be interpreted to mean the construction of knowledge without a context of use. This disassociation of knowledge without the context of use may contribute to weaker understanding, coercive curriculum and negative attitudes towards learning.

In attempts to implement constructivist theory, teachers and curriculum designers often create situations in which a student will "discover" a particular concept, rule or fact without any authentic context or motivation for making such a discovery. The deliberate attempt of one person to "lead another to discover" a concept deprives the learner of a powerful intellectual adventure. Piaget's powerful idea that all learning takes place by discovery is emasculated when school practice translates this idea into "discovery learning". This idea is disempowered when it is orchestrated by the preset agenda of a curriculum. Learning is also weakened because the ideas being learned are disempowered by the act of removing them from a context for authentic discovery arising from need or serendipity. Constructionists are concerned with the goal of re-empowering the powerful ideas learned by students by taking a step towards re-empowering the idea of learning by discovery. (Papert 2000) Elaborate "real world" scenarios created by educators often do great violence to the important idea that knowledge is situated, by forcing students to confront a concept they see to have little relevance now or in the future of their high-tech society.

Papert argues that cognitivists also misinterpret constructivism by believing that a student will learn better by understanding the intellectual methods used for solving a particular problem if she understands the concepts behind them. This might be so if the student appreciates the beauty or power of those ideas, but in too many cases the cognitivist is trying to get the student to see the connection between one set of ideas about which she does not care and another. The cognitivist does little to create an environment in which a student can experience the same intellectual situation in which those ideas were invented. This may lead ultimately to weaker understanding of that concept and a poorer concept of the individual as a capable learner.

The theoretical basis for the CLL develops from Papert's work most completely described in his books *Mindstorms: Children, Computers and Powerful Ideas* (1981), *The Children's Machine* (1993) and *The Connected Family* (1997). These seminal books in the field of educational computing detail more than four decade's worth of thinking about learning with computers.

Constructionism predicts that individuals learn best by mobilizing their entire selves in a personally meaningful pursuit while sensing that their work is valued as part of a larger enterprise. This type of learning is hard, long-lasting and requires more time than is typically afforded by the bifurcated secondary school curriculum.

Constructionists argue that learning is active and superior to a pedagogy of learning by telling. They value a plurality of definitions, meanings and ways of knowing. Learning is highly personal and controlled by the learner. Constructionists believe that learning requires taking a stance, seeking and finding one's intellectual identity, owning the artifacts of learning and finding your own voice. (Harel 1993)

Constructionists recognize an important role for technology in learning. The computer is a particularly flexible, expressive and intellectually rich medium for "messing about" with powerful ideas. For learners, the computer provides an unrivaled intellectual laboratory and vehicle for self-expression. The computer becomes the workspace within which students can, for example program video games, construct simulations, perform calculations, store their journals, publish newsletters, correspond with experts, edit video, produce animated films, learn to fly an airplane and much more.

Powerful Ideas

The exploration, construction and articulation of powerful ideas are at the focus of a constructionist learning environment. Seymour Papert believes that *when ideas go to school they lose* . (Papert 2000) It is therefore the challenge of a constructionist learning environment to create situations in which students may not only discover powerful ideas, but perhaps the most powerful idea of all – the idea of powerful ideas.

Students in a constructionist learning environment will eagerly investigate powerful ideas at the forefront of intellectual exploration and express their knowledge through the construction of sophisticated long-term projects. It is believed that through the construction of personally meaningful projects students will not only develop content-area knowledge, but the habits of mind and social skills required to make contributions to society in the twenty-first century.

In *The Having of Wonderful Ideas*, Duckworth (1996) supports the educational efficacy of student projects when she says that intelligence cannot develop without matter to think about. Making new connections depends on knowing enough about something in the first place to provide a basis for thinking of other things to do – of other questions to ask – that demand more complex connections in order to make sense. The more ideas people already have at their disposal, the more new ideas occur and the more they can coordinate to build up still more complicated schemes. This suggests that a child comfortable tinkering with familiar items and playing with ideas will gain the confidence and self-awareness required to solve a wide variety of problems.

The CLL shares the sentiments of Newell who suggests that learning best occurs through a plethora of explorations that lead to:

- crossing subject boundaries
- crossing subject boundaries in fuzzy and unexpected ways
- avoiding the feelings; "I cannot learn!" "I am stupid" "I am not good enough at this"
- pursue things that fascinate you
- innovation and invention
- explorations that feel like play. (Newell 1993)

Project Significance

Personal digital technologies offer a powerful medium for the construction of knowledge in a social setting. Earlier research supports the hypothesis that children are capable of constructing knowledge when using computational materials in a social setting.

Harel demonstrated that children asked to learn traditional concepts in traditional schools were more likely to gain a deeper understanding of those concepts if immersed in a constructionist activity. The students in Harel's research were asked to use Logo software and microcomputers to design educational software that would teach another child about fractions. Questions remain about the effect of limiting student learning to the arbitrary constraints of the curriculum. The existing body of research attempts to investigate the theory of constructionism in traditional schools. In other words, constructionist activities were executed in relatively unchanged schools.

Since constructionist theory addresses both the cognitive and social aspects of learning, it is important to research the application of the theory in an environment designed from the bottom-up to reflect such principles. The learning environment embodied by the CLL addresses the challenges associated with changes in the nature of teaching and learning, professional development, curriculum, assessment and the use of personal computing in learning. These variables reinforce one another and are impossible to address in isolation.

While much has been written about the theoretical basis for constructionism attempted in more traditional school settings, the CLL project offers the first opportunity to document a full-scale implementation of constructionism in an computationally rich alternative-learning environment built and directed by Papert. This represents another step towards defining constructionism as a viable learning theory.

CLL Examples from the First Year

CLL students use rich computational media like LEGO's programmable RCX brick to construct fantastic inventions. Building with LEGO is the focus of many activities in the CLL. The LEGO bricks, gears, motors, sensors and programmable brick create an improvisational medium in which the top-down planner and bricoleur (tinkerer) alike can explore powerful ideas in math, science, computer science by building something "real."

One student read newspaper articles detailing Coca Cola's plans to test a new vending machine that would charge more for a soft drink on hot days. Most CLL students thought this was unfair, but it was suggested that they could build a working prototype of the vending machine out of LEGO. Although the student protested that he couldn't build something that complicated, he and a classmate began work on the construction of such a device. Figure 2. Having triumphantly constructed and programmed a successful temperature-sensitive Coke machine, the student proceeded to write a letter to the Chairman of Coca-Cola. The letter included photos of his prototype and an offer to build a full-scale model. The student received a letter denying that the company had ever contemplated charging customers in such a way. The disappointed (and thirsty) student then put his letter alongside of the letter from Coca-Cola and the newspaper articles announcing the new machine in the class newsletter.

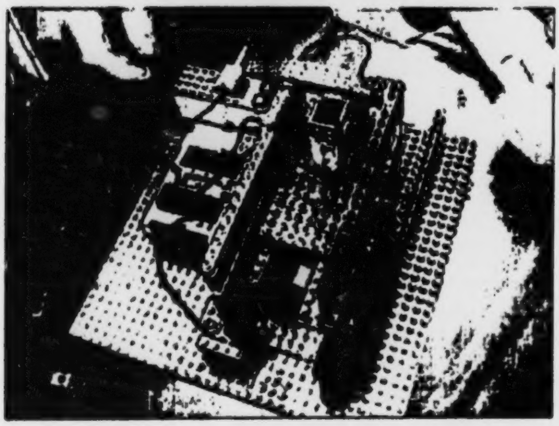

Figure 2

The same student then constructed an ingenious conveyor belt system designed to route baggage at an airport. Different color LEGO bricks were used to represent bags heading for one of four airplanes. A light sensor was calibrated to report the amount of light reflected off each color brick. This data was used to 'teach' the programmable LEGO brick to automatically direct the baggage in one of four different directions. Countless engineering challenges dealing with ambient light, sensor errors, gearing, timing and structural concerns had to be overcome in order to construct the brilliant piece of robotic engineering pictured in Figure 3.

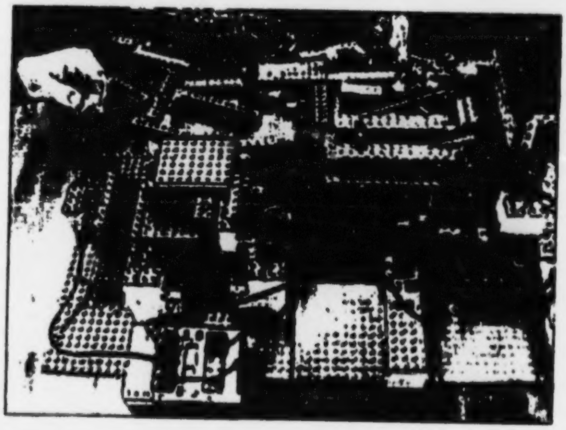

Figure 3

Students build robotic arms, machines that play the xylophone, robot sumo wrestlers, machines that can mechanically write their name and gearboxes that can pull impressive quantities of mass Figures 4 and 5. They are expected to explain their inventions and the process they experienced constructing a working device. Learners use various media to document their learning processes and to archive their finished product in an attempt to demonstrate their knowledge and reflect on their learning.

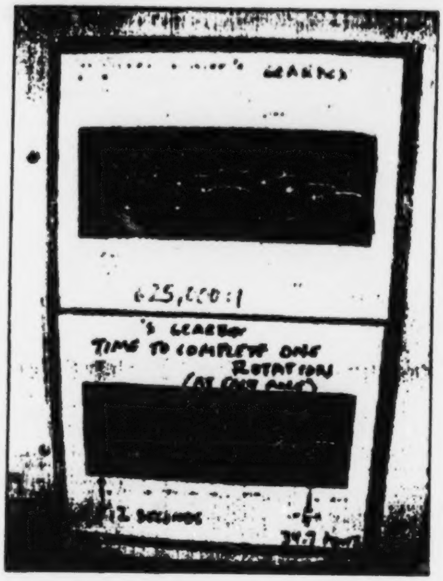

Figure 4

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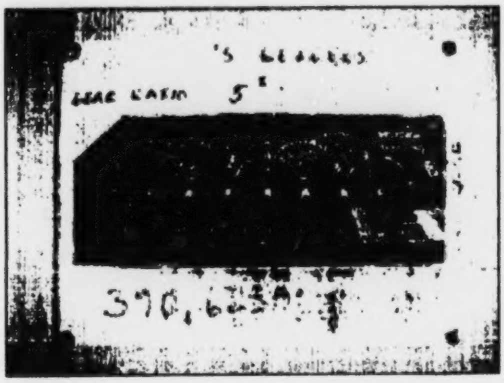


Figure 5

Technology is a ubiquitous part of the lives of kids and should be reflected in their learning experiences. Young people have a casual relationship with technology and can even be quite playful with it. An example of this playfulness is embodied in the digital gingerbread houses built by CLL students at Christmas time. Each child built a house of graham crackers, icing, cookies, candy and a small computer tucked away inside. Their houses had twinkling lights, programmed carols performed by the LEGO brick, doorbells and spinning trees made of Hershey Kisses. Figure 6

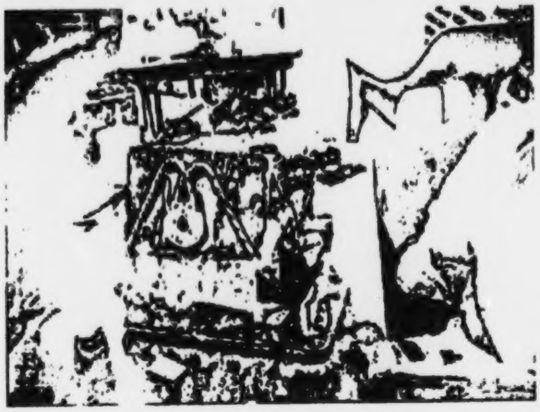


Figure 6

Is this cheating or just good science?

Themes often link a variety of projects and connect the learning experiences to a larger body of knowledge. A theme unifies individual discoveries and makes explicit connections between implicit knowledge. Themes may be related to content areas such as optics or organized around a challenge. One such theme involved challenging the students to build a LEGO vehicle capable of climbing the steepest ramp.

The competitive nature of this challenge led students to construct countless vehicles. Observations and data collected from previous attempts guided the systematic development of more sophisticated devices. Students soon understood that there were only four causes of failure: too much friction; too little force; center of gravity; structural inadequacy (it busts apart). Such important scientific principles guided significant improvements in subsequent vehicles.

One girl decided to put sandpaper on the ramp to see if it would aid in the climbing effort. The young engineer tried different grades of sandpaper and when she found the sandpaper responsible for the best climbing she decided to investigate the reasons why. The sandpaper and LEGO tire were examined under a microscope. Had this been an ordinary microscope no discovery would have been made. The Intel QX3 microscope allowed the student to print out the magnified images of the two surfaces. By looking at these printouts side-by-side the student was able to see that the surface of the tire and sandpaper were similar enough to work like teeth in two gears – thereby allowing the vehicle with those tires to climb a ramp made of that surface. This "eureka" moment might not have occurred in a traditional classroom without microscopes or with an analog microscope incapable of printing a magnification.

A group of students noticed that their vehicle attempted to climb the wall after reaching the top of the ramp. This observation inspired many additional explorations, including the question of building a vehicle that could climb an incline greater than ninety degrees. One ingenious student asked the teacher what she meant by "climb the ramp?" She improvised an answer that "climbing the ramp meant that the front wheels of the vehicle had to cross a particular line." He asked if she were sure and when satisfied with the ruling set-off to defy physics by constructing a vehicle capable of climbing an incline of approximately 110 degrees. The result may be seen in Figure 7.

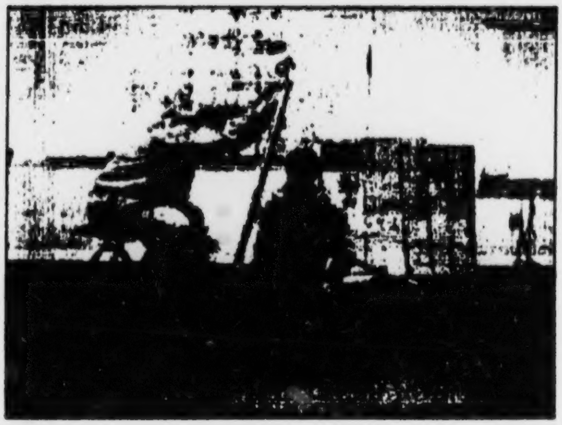
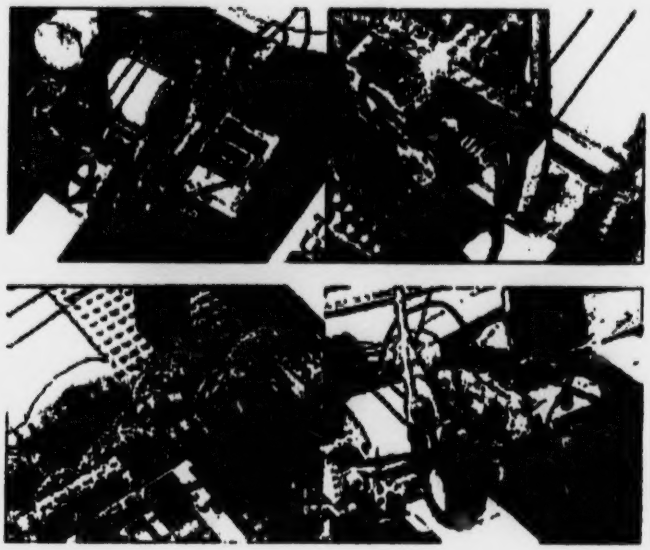


Figure 7

While traditional curricula would allow a teacher to check off "uses a protractor" from a list of objectives, the kids in the CLL learned so much more. Students attempting to "win" the ramp climbing challenge learned a great deal about perseverance, debugging, gearing, limits, scientific conventions, programming, force, friction, magnification, center of gravity, structures, the scientific method and many more powerful ideas by doing science rather than being taught about science.



Views of a student invention designed to graph fluctuations in outside temperature over a several day period.

The CLL does not focus exclusively on the use of computers by students. Kids read books, write plays, produce videos and publish newsletters. In fact, exciting work has been done with wood. Under the direction of John Stetson, CLL kids have built beautiful handcrafted classical guitars. These instruments are complete with wood inlay and reflect a level of precision usually reserved for master craftspeople. These guitars require hundreds of hours of careful labor and provide opportunities to confront challenges like humidity. Kids learned that if the humidity is not within a certain range, their wood may swell or crack. Humidity was not merely a vocabulary word for them, but rather a force of nature they needed to overcome. The construction of ultralight airplanes capable of flying for minutes unpowered, handmade telescopes and camera obscuras offer these learners opportunities to better understand the world around them. It is hoped that these powerful experiences provide students with a way of viewing the world so they may live happily and make important contributions to the world of ideas.

The CLL offers a model of constructionism complete with ubiquitous digital technology and important school reform strategies with a population of at-risk students. The lessons learned from this project should benefit all populations of learners. The goal is to engage children in unprecedented learning activities while offering the world a new way of thinking about creating learning environments for the 21st Century.

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The Evolving Role of School-based Technology Coordinators in Elementary Programs

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Key Words: **technology coordinator, on-site support, staff development, technology integration**

Introduction

While much has been written about the potential of computers to enhance teaching and learning, a wide range of research studies and reports suggest that K-12 schools are not fully realizing the potential of new information technologies. One recent report suggests that while technology implementation in education is improving, only 24% of schools are using computers effectively (CEO Forum, 1999). Commonly cited reasons include inadequate computer resources, lack of teacher preparation, lack of planning time, and lack of on-site support (CEO Forum, 1999; National Center for Education Statistics, 2000; Ronnkvist, Dexter, & Anderson, 2000; U.S. Congress, 1995). Several studies (Evans-Andris, 1995; Marcovitz, 1998; Moallen & Micallef, 1997; Ronnkvist, Dexter, & Anderson, 2000; Strudler, 1995-96, Strudler & Gall, 1988) have documented ways in which effective technology coordinators have helped schools to overcome these impediments to computer implementation. Despite clear evidence supporting the need for such positions, however, most school districts have been hard pressed to allocate funds on a large-scale to support released-time technology coordinators (Ronnkvist, Dexter, & Anderson, 2000).

In 1997, the Clark County School District (CCSD) in Las Vegas, NV approved a plan to provide released-time coordinators to facilitate technology integration in all of its K-12 schools. This paper documents the implementation of that plan in CCSD's elementary school programs. It begins with some background information, followed by a description of the study, the results obtained thus far, and a discussion of the findings and their implications for practice.

It is hoped that this research will provide increased understanding of the long-term problems involved in integrating technology in schools as well as effective strategies for overcoming these problems. Furthermore, its findings may help technology coordinators be more effective as agents of change and enable their supervisors to provide better guidance and support.

Review of Related Literature

The role of instructional computer coordinator emerged during the 1980s along with the proliferation of computers in K-12 schools (Barbour, 1986; Moursund, 1985). Electronic Learning's first annual computer coordinator survey (Barbour, 1986), revealed the following:

1. Job descriptions vary greatly.
2. Only 21 percent of the respondents actually hold the title "computer coordinator"; the other 79 percent function in that role on a de facto basis.
3. Eighty percent of school computer coordinators who responded fulfill their role as an additional responsibility; only 4 percent fulfill their role on a full-time basis, while 16 percent function on a part-time or "released" basis.

Results from further national surveys (Bruder, 1990; McGinty, 1987; Ronnkvist, Dexter, & Anderson, 2000) have documented the growth and challenges of this evolving role. The most current of those surveys reports the following (Ronnkvist, Dexter, & Anderson, 2000):

1. Eighty-seven percent of schools surveyed have technology coordinators, but less than one of five of them (19%) reported having full-time coordinators.
2. High schools were twice as likely to have full-time coordinators than were middle and elementary schools.
3. Technology coordinators provide more technical support than instructional support to teachers integrating educational technology.
4. Teachers in schools with high quality technical and instructional technology support are more likely to engage in more and varied uses of technology in their schools.

Various case studies (Evans-Andris, 1995; Marcovitz, 1998; Moallen & Micallef, 1997; Strudler, 1995-96, Strudler & Gall, 1988) have provided rich descriptions of the work that technology coordinators perform. One longitudinal study, consisting of an initial investigation (Strudler & Gall, 1988) and a follow-up (Strudler, 1995-96) reported on the skills and strategies used and the outcomes effected by three exemplary coordinators over a period of eight-years. Results across cases suggest that while barriers to increased technology use have been eliminated or minimized due to the work of the coordinators, many obstacles still remained. One finding of particular interest involves the coordinators' plans "to work themselves out of their jobs." Findings suggest that this ambitious goal appears to have underestimated the degree to which educational change with technology is a moving target that requires ongoing coordination and support.

Educational Computing Strategists Role in CCSD

In the spring of 1997, the Clark County School District (CCSD) in Las Vegas, NV approved a plan to provide a technology coordinator, later termed Educational Computing Strategist (ECS), to each elementary school in the district. CCSD is currently the sixth largest school district in the country and is the country's fastest growing major school district. The plan involved a three-year phase-in for elementary schools.

During the first year of the project in 1997-98, data were gathered on how 24 ECSs were spending their time while performing their role. Commonly cited functions included providing staff development, managing local area networks, providing for their own professional development, and carrying out miscellaneous non-technical duties (Anderson, D.G., 1998)

In 1998-99, an additional 45 ECSs were hired to bring the total number in the District's elementary schools to 69. Unfortunately, further funding for the full implementation of the ECS role was not forthcoming. Currently 69 ECSs serve CCSD's 160 elementary schools.

Methods

Phase I

In spring 1999 and fall 2000, surveys were administered at meetings of the elementary ECSs to gather data on various aspects of their role. The five-page survey, administered in April 1999 was adapted from a 17-page questionnaire for technology specialists designed by Becker & Anderson (1998). The return rate for our survey (n=57) was 100% since the surveys were administered and collected during the ECS meeting.

A second survey was conducted in September 2000. Based on the 1999 instrument, some items deemed less important were eliminated to pare the survey down to four pages. Again, the survey was administered during an ECS meeting for a return rate of 100% (n=63).

Both surveys addressed the following research questions:

1. How much time do ECSs spend performing the various functions of their role? How much time would they like to spend performing these functions?
2. How effective do ECSs feel in performing their role?
3. What are the perceived obstacles to greater integration of technology into the curricula?
4. What are the intended and actual accomplishments resulting from the ECSs work?

Data from the surveys were analyzed using SPSSx. Results were compared from the 1999 and 2000 surveys. In addition, findings were compared against those of Ronnkvist, Dexter, & Anderson (2000), who used the same Technology Specialist's Survey (Becker & Anderson, 1998) that served as a model for our surveys.

Phase II

Following the administration of the two surveys and preliminary analysis of the data, additional research questions emerged. We wanted to inquire further into issues of effective implementation of the role, some ECSs' dissatisfaction with their role, and how the role might evolve in the coming years. Specifically, we posed the following additional questions:

5. What recommendations do ECSs have for the effective implementation of their role?
6. What factors led to some ECSs not to return to their positions?
7. How should the ECS role evolve in the coming years?

To answer these questions, a series of interviews were planned. The Elementary District Coordinator (who serves as Co-PI of this project) contacted nine ECSs who have recently left that role to return to positions as classroom teachers. Of those, seven agreed to participate in an interview. In addition, we sought to interview a selected sample of ECSs who were deemed exemplary by their peers and deemed to be functioning at a high level of satisfaction. Members of the Elementary ECS leadership team were polled to identify people in each of the four regions in the district who they believe meet these criteria. The results were compiled and six people were identified for interviews.

Semi-structured interviews were administered to address all of the research questions (i.e., the initial four questions and the additional three listed above). At the time of submission of this paper, all seven of the "non-returnees" were interviewed, as were four of the six "exemplary" informants. The remaining two interviews were scheduled, but not yet implemented.

All audiotapes were transcribed. Using the constant comparative method (Strauss, 1987), data analysis began as data were first collected and continued throughout the study. We began by reading the transcriptions of the interviews. Guided by the purpose of this study and general categories used in the surveys, we created a series of codes. Two of the researchers then coded sample transcripts, compared results, and modified codes as needed to establish consistency in the coding process.

We then reread hardcopies of the remaining transcriptions, identified illustrative comments, and marked applicable codes for each "chunk" of data. As the analysis progressed, we added a couple of codes to reflect topics that we had not anticipated. Subsequently, we used the ClarisWorks database and word processor components with embedded macros to transfer "chunks" of data from the transcripts (word processor files) into individual records in the database program. This allowed for assigning one or more codes to each "chunk" and subsequent searching and analysis of the data.

Results

Results of this study, based on survey and interview data gathered thus far, are organized by research questions. Some brief demographic information precedes these findings. Due to space limitations, questions five through seven, which were addressed during our Phase II interviews, will not be reported in this paper. Furthermore, interview data that address questions one through four will be cited sparingly.

Survey data from 1999 disclosed that a slight majority of the ECSs are male (54.4%). The ECS served an average of 64 teachers and 1149 students. In 2000, ECSs served an average of 80 teachers and 1352 students. 1999 surveys indicate that the typical ECS has been a classroom teacher from four to 11 years, while the median years teaching with computers is between four and seven. See Figure 1 for data pertaining to ECSs' teaching experience.

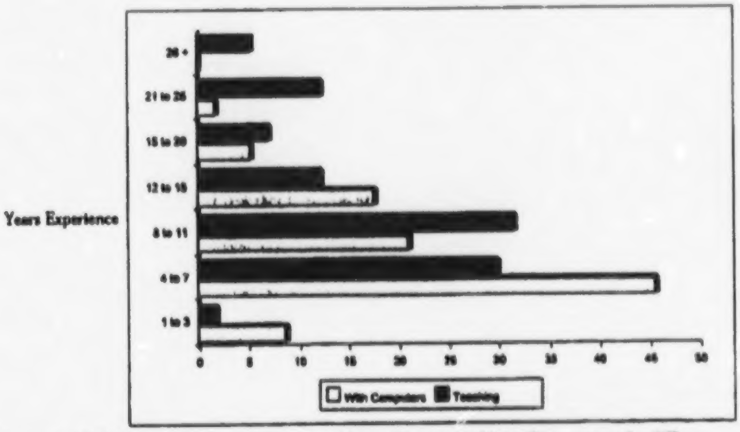

Figure 1: ECS Years Teaching Experience Years Teaching With Computers (n=57)

1. How much time do ECSs spend performing the various functions of their role? How much time would they like to spend performing these functions?

Table 1 shows the amount of desired and actual hours that ECSs reported for 1999 and 2000. Inexplicably, respondents reported spending less total hours performing their jobs in 2000 than they reported for the prior year, despite some additional assignments in 2000. One possible explanation is that more of the ECSs who are working at multiple schools are possibly not accounting for the amount of time they spend driving from one school to another or performing similar tasks at a second site. Another possible explanation is that ECSs, who have historically worked well beyond the required hours, are now less willing to do so. Interview data, however, don't support this theory. A third explanation might be that that the total hours reported by the ECSs are not accurate. We will seek to reconcile this finding by having study participants review a draft of this paper and subsequently participate in a focus group to discuss key findings and issues raised in the paper.

ECS Functions	1999 Actual	1999 Desired	2000 Actual	2000 Desired
Supervising and assisting classes of other teachers	10.43	8.25	6.26	8.79
Supporting or training individual teachers	6.03	7.15	6.51	6.82
Installing, troubleshooting, equipment & software	12.11	6.18	13.79	4.89
Planning and running staff development workshops	3.55	4.39	2.70	5.42
Writing lesson plans and units with other teachers	2.89	5.11	1.66	4.29
Selecting and acquiring resources	2.68	2.11	1.56	1.51
Other coordination and support	3.16	1.01	1.90	1.02
Total	40.85	34.20	34.38	32.74

Table 1: Actual and Desired Hours Reported Spent on Various ECS Functions

Survey data indicate that the coordinators spend a good deal of time providing technical support—clearly more than they desire. On the other hand, they report spending less time than they desire on functions related to instructional issues (e.g., staff development workshops and writing lesson plans and units with other teachers). Figure 2 illustrates the increasing amounts of time reported installing and troubleshooting hardware and software juxtaposed with the desired amount of time for these functions. These results are consistent with Ronnkvist, Dexter, & Anderson's (2000) findings that technology coordinators provide more technical support than instructional support to teachers integrating educational technology.

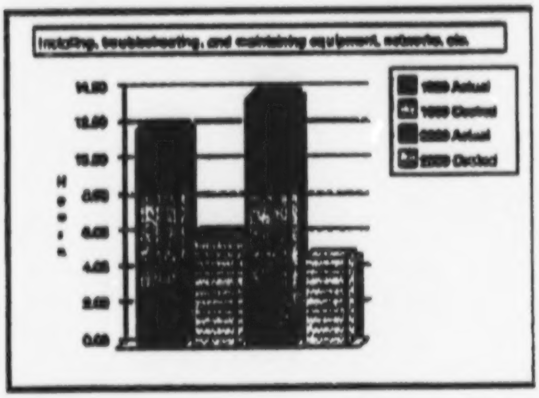

Figure 2: Hours Reported Performing Technical Functions

Interview data further confirm the technical demands of the job and the difficulty that the ECSs find in fulfilling their desired roles as onsite staff developers and curriculum consultants. Furthermore, survey data indicate that ECSs report not having adequate time to perform their role (see Figure 3). Additional technical responsibilities assigned to them likely account for this increasing perception reported in the 2000 survey.

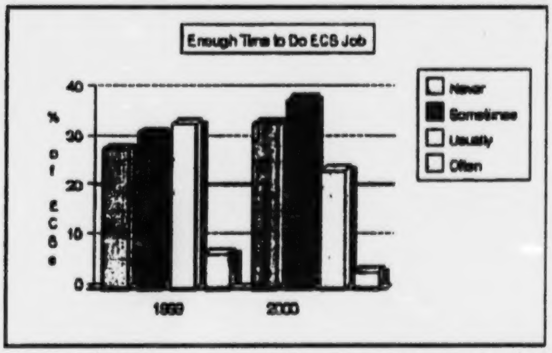

Figure 3: ECS's Responses to: "I Have Enough Time to Do My Job Well"

2. How effective do ECSs feel in performing their role?

Interview data indicate that the ECSs generally feel effective in their role. Many report a sense of accomplishment as they note that more teachers are seeking their services and using technology with their classes. One respondent characterized the progress that many noted, "They are coming in more and seeking my expertise. That has been a very good change."

One factor in respondents' sense of effectiveness reflects the amount of time that they spend performing particular functions. For example, ECSs reported an increase in effectiveness in performing technical functions such as troubleshooting and maintenance (see Figure 4) and a decrease in effectiveness regarding running and planning staff development (see Figure 5) and supporting and training individual teachers.

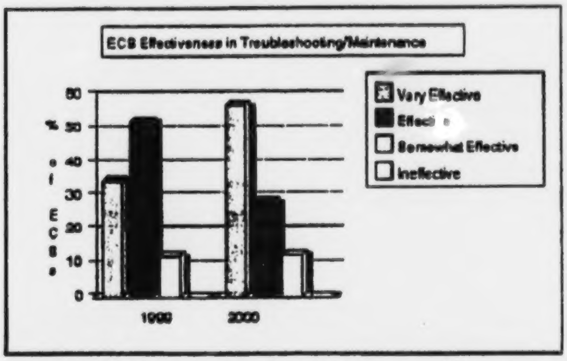

Figure 4: ECS Effectiveness in Troubleshooting and Maintenance

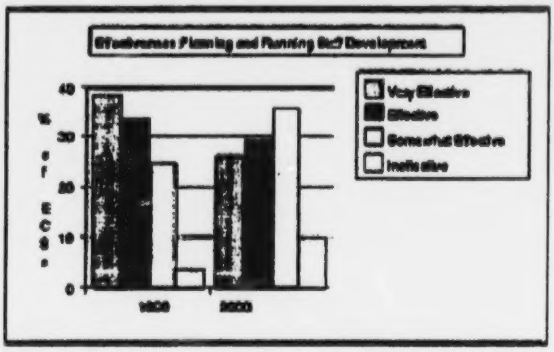

Figure 5: ECS Effectiveness in Planning and Running Staff Development

Interview data suggest that ECSs's sense of effectiveness varies with a range of factors related to their particular school context. Clearly, the technical expectations for the role are a key factor. While it appears that most coordinators feel positive about their ability to perform technical functions, one respondent noted a frustration shared by some others. She stated, "Having to address too much technical, I really felt like almost at times you had to be a CNE [Certified Novel Engineer]." Overall, it appears that an increasing emphasis on technical responsibilities, coupled with a larger client base, is making it difficult for many ECSs to feel effective in the professional development functions of their job. It should be noted that professional development and support was identified as a primary function of ECSs when the position was created.

3. What are the perceived obstacles to greater integration of technology into the curricula?

Coordinators identified the following obstacles to technology integration in their survey responses: limited budget, teachers' lack of interest or time, too few computers in classrooms, and obsolete technology. These impediments are consistent with other studies examining technology integration (CEO Forum, 1999; National Center for Education Statistics, 2000; Ronnkvist, Dexter, & Anderson, 2000; U.S. Congress, 1995). Additional obstacles raised in interviews include the lack of a clear vision for technology use and a lack of agreement among teachers, ECSs, and administrators regarding how to best implement the ECS role and achieve school goals.

Specifically related to the coordinator role, one respondent identified the competing demands placed on ECSs as an obstacle. She explained, "I really think that there needs to be both a technical person and an ECS addressing curriculum in the schools. I think it's too difficult to expect the ECS to address both."

4. What are the intended and actual accomplishments resulting from the ECSs work?

A large majority of ECS were in agreement with the general goals and job description as stipulated by the district— providing staff development and support, performing basic maintenance of hardware and software, and leading technology planning and coordination. One ECS characterized well what others are attempting and actually accomplishing. She noted, "My greatest successes were seeing teachers [have] that light bulb moment they always talk about with children"—when they discover an applications that really fit with what they are trying to accomplish in their classroom. Another shared a similar sense of accomplishment: "The teachers are actually using those things in the classroom. And they are so excited about doing it too."

Other respondents discussed the accomplishment in helping teachers build a vision for technology in their school. For example, one explained that "teachers are excited about the technology and they're thinking ahead to how they could integrate that and [they are] beginning to dream a little bit...." This outcome reflects a clear sense of progress toward the ultimate goal of empowering teachers and ultimately transforming teaching and learning with technology.

Discussion and Implications for Practice

This study further documents the complexity involved in effectively integrating technology in school programs. Clearly, basic technical functions that coordinators perform are prerequisite to achieving the higher order outcomes that may enhance teaching and learning in significant ways. The goal, then, is to establish an efficient solution for providing technical maintenance and support so that coordinators have sufficient time to pursue the "higher order" goals of providing staff development, curriculum consulting, and follow-up support. Data from this study confirm that while the basic technical functions are being consistently provided—a positive outcome in its own right--a variety of factors contribute to a coordinator's effectiveness in supporting technology integration and curricular change.

Participants in this study offered a range of recommendations regarding how to reap the greatest benefits from the ECS role. Some emphasized the need for administrative support and vision for technology use. Clearly, this appears to be a common factor among schools with effective coordinators who report making good progress with technology integration.

Others recommended the need for increased technical support from alternative sources (e.g., technicians, students, other teachers). Regarding staff development, some argued that principals should mandate attendance and participation. Others favored a more patient approach in which teachers would seek the services of ECSs based on their motivation and readiness.

Overall, it appears that there is great benefit derived from the work that ECSs perform. Specifics regarding the implementation of the role, however, require further study. In the best of all worlds, there would be adequate funding to support all of the coordination and implementation support necessary for effective technology integration. But in a world of limited resources, optimal implementation of a school technology coordinator role must be examined. Can some of the technical services that ECSs provide be delivered in a more cost-efficient manner? Should access to an onsite staff developer and curriculum consultant be viewed as an entitlement or "basic service" for all teachers or should it be viewed as a limited resource? If viewed as a limited resource, should those schools receiving such services require that teachers participate in technology-related staff development?

These, and other related questions will be addressed through a more detailed analysis of interview data and a follow-up focus group. Results will be forthcoming at our NECC 2001 presentation and subsequently discussed in an extended version of this manuscript.

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Building Positive Attitudes Among Geographically Diverse Students: The Project I—57 Experience

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Key Words: Computer-Mediated Communication (CMC); contact hypothesis; multiculturalism; regional diversity; social, ethical and human issues

Introduction

This paper is a study of computer-mediated intergroup contact within Project I-57, a larger educational technology project funded by a one-year ISBE grant (Technology Literacy Challenge Fund) and conducted during the 1998-99 school year. Participating institutions were five middle and high schools in three distinctive geographic/cultural regions along north-south Illinois highway I-57: the Chicago area, the central farm belt, and Southern Illinois. The students varied not only geographically, but also socially by community size, ethnic make-up and age. The Department of Educational Psychology at the University of Illinois (Urbana-Champaign) served as one partner institution.

The project's goals were to foster multiple skills (reading, math, etc.) via authentic student research on their communities and to "make [their] students' worlds bigger" through sharing about themselves and their (cultural) communities with classes in other regions to create an appreciation of the state's diversity.

The goals of this present study were to evaluate expected changes in students' "understanding" of the other two regions and populations in the twofold sense of *knowledge* of and *attitudes* towards the "outgroup"—more positive ones, it was hoped—due to the virtual contact and greater knowledge facilitated by the project. As Stephan & Stephan (1984) write: "Due to the information exchange, intergroup interaction … can increase knowledge about outgroup members and reduce intergroup anxiety, which in turn broadens the perceptual field to allow impressions of outgroup members to become more accurate and more favorable."

Such optimistic expectations have commonly been laid on the Internet to be such an agent of positive social change by expanding mutual knowledge among diverse communities/nations. The results of such virtual contact, however, have not always lived up to the hype and have at times contradicted it. Meagher and Castaños (1996), for instance, write of their experience in a CMC project between a Mexican and US high school in which Mexican students' attitudes towards US culture grew less positive after a CMC cultural exchange, although students felt greater commonality with the American individuals they had communicated with. Similarly, some post-test essays by Project I-57 students reveal an increased (supposedly more knowledgeable) negative perception towards the communities and individuals they have been in contact with. Other studies have also detected decreased self-esteem in the lower-status group after intergroup contact.

These are useful reminders, then, that successful social change via CMC activities is not a given. The potential for hardening already negative attitudes is just as real. This paper therefore is an attempt to find theoretical guidance from research in the "Contact Hypothesis" framework in (a) interpreting the complex virtual contact experiences of this real-world cross-cultural project and (b) devising principles for planning future such projects to more predictably live up to educators' idealistic social expectations.

Types of CMC

The grant goals mandated engaged learning activities through student research on their local communities, the data from which was communicated to the other schools via class Web sites and other CMC media such as electronic Web postcards, on which students described themselves, e-mail keypal relationships, and CU-See Me live camera interactions. Despite technical problems, one of the key factors in the success of the CMC contact was the frequency of interaction, not the medium.

One particularly successful cross-cultural activity was a live CMC show-and-tell between classes at Benton and Maine East (Chicago) in which each student brought an object that was precious to them and explained why. Benton's mainly WASP students showed family heirlooms or favorite collectibles, whereas many of the immigrant students at ME showed religious objects.

Student Demographics

Geographical variance was one of the assumptions of the original grant: students from parts of Illinois that rarely interact would, thanks to the computer, finally connect. At Maine East and West High Schools in the NW Chicago suburbs, students were multiethnic, at-risk freshmen. One private boys High School in the same region, Notre Dame, also participated. Fisher Grade School's 4h and 5th grades represented the central downstate farm belt, although surprisingly most students' parents did not work directly in agriculture. Benton Middle School's 8th graders represented far southern Illinois, a former coal-mining community culturally more Southern than Midwestern. None of the teachers or students had previously communicated with Illinois schools outside their own area, and although many in central Illinois and a few from Benton had visited Chicago, hardly any from up north had visited Southern Illinois.

Socially, schools differed by community and school size: large Chicago suburban communities with large schools versus small town schools in Fisher and Benton, where "everyone knows everyone." Classes also differed in ethnic make-up, with Fisher and Benton mainly composed of white, native-born students and the Chicago schools composed of a multiethnic, heavily immigrant student body. Age was another variable, with students ranging from 10 years old in Fisher to 16 at Maine East, a cognitively and socially significant gap.

The 'Contact Hypothesis' and Related Research

To better interpret the complex qualitative data in this study, I looked to the "Contact Hypothesis" (Allport 1954). CH, at its most basic, is the prediction that positive contact between different groups and increased mutual knowledge will reduce intergroup bias, conflicts, and tension. It is not value-neutral in that proponents also advocate practical interventions to achieve this outcome.

Originally the hypothesis was meant to lessen racial prejudice in the US and led to educational solutions such as school desegregation and bussing of minorities. However, it deals with intergroup bias in any form, and indeed the framework has been extended to conflicts between Arabs and Israelis (political and ethnic), Catholics and Protestants in Northern Ireland (religious and political), and merged corporations (c.f. Hewstone & Brown 1986).

Studies show that people are more helpful to members of their ingroup than an outgroup and apply different, more generous standards of morality, justice, and fairness to ingroup members. Intergroup competition and historical conflict load any contact with anxiety and status inequality. Increased knowledge of the outgroup, however, and positive personal contact is theorized to lesson bias.

Allport and others in the framework list various prerequisite conditions for successful intergroup contact:

- equal status contact between groups (inside and outside contact setting)
- minority group representatives coming from the higher status within their community
- supportive norms (ground rules) that support egalitarian intergroup interaction—perceived support from authorities
- Pre-training of both groups in higher expectations about the lower-status/minority group

And conditions during planned contact:

- working together: cooperative intergroup interaction / interdependence on functionally important common tasks
- opportunities for personal acquaintance between outgroup members
- intimate/personal contact rather than casual (Amir)
- high enough frequency of interaction to increase knowledge of the outgroup (Hamilton & Bishop)
- avoidance of potentially divisive issues and differences in early stages (Ben-Ari and Amir)

Amir also lists negative contact conditions:

- contact which produces competition
- contact which is unpleasant, tense
- contact which lowers one group's prestige
- each group holding conflicting moral/ethical standards that are objectionable to the other
- minority group members being of lower status in any relevant characteristic than majority members

One contemporary cognitive model derived from the CH framework is the Common Ingroup Identity Model (Gaertner & Dovidio 2000) in which the goal is to recategorize competing groups' cognitive social representation from separate groups to one superordinate group while not losing a positive original group identity (e.g. members of the same team with different roles/strengths). They list various mechanisms to foster recategorization and reduce bias:

- planning for intergroup cooperation (*not* competition) and interdependence, with full interaction best
- cognitive priming: Emphasizing existing commonalties and creating new ones (e.g. identical dress, new group name) to form a common identity
- introducing new common goals or fate / shared outcome
- affective priming: Manipulating affect (feelings) prior to group contact to create a positive mood (for neutral intergroup situations)—i.e. giving candy bars, showing a comedy (This may not work for intergroup situations with negative histories and attitudes.)
- encouraging "dual identity": Don't threaten positive subgroup identities and distinctiveness—multiculturalism
- when a superordinate group identity has been established, encouraging prosocial behaviors such as self-disclosure and helpfulness, which further solidify good relations
- Match groups by status based on complementary, not competitive, expertise (positive distinctiveness)

In naturalistic intergroup situations, however, it is often difficult to establish all the conditions called for by CH theorists, especially the prerequisite that both groups be of equal social status. This is particularly true in the Project I-57 school pairings. Higher status is linked to variables such as one's community (urban vs. rural), age (older vs. younger - critical among K-12 students), family income (middle- vs. working class), family occupation (urban versus rural jobs such as farming or coal-mining), nationality (native-born American vs. immigrant), and race/ethnicity (white vs. non-white).

Status inequity (Stephan & Stephan 1984) can result in differing degrees of awkwardness, self-consciousness, confidence, defensiveness, comfort etc. within group members. Living in adjacent neighborhoods can also create feelings of threat and anxiety, which are minimized by the distance CMC projects like Project I-57. The more a superordinate group is perceived by all, however and the more favorable the contact, the lower the anxiety and outgroup bias.

Results

Data comes from pre- and post-survey essays about the other two regions and pre- and post-survey questionnaires (see Web site for more). The pre-survey questionnaire gathered demographic information on students; the final questionnaire dealt with CMC experiences and changes in attitude/knowledge. Data from the partner schools' communication is regrettably unequal. Benton and Maine East (Chicago) had the most extensive and successful communication and therefore the most complete data. Fisher communicated minimally with Notre Dame High School, but post-survey documents were never received from the latter institution; thus, data comes from only one side of the intergroup interaction. Maine West (Chicago) communicated only once with Fisher, and thus I chose not to include that post-survey data. All responses are unedited.

Benton- Maine East (Chicago)

Benton n = 20 (8 male, 11 female, 1 not mentioned), ages 13-14
Ethnicity: white (all)
Birthplace: US (all)
Language at home: 18 English, 2 spoke a foreign language at home

Maine East (ME) n = 41 (21 male, 20 female), ages 14-16
Ethnicity: 16 white, 7 Hispanic, 20 Asian (various), 1 black
Birthplace: 23 born overseas
Language at home: 36 spoke a foreign language

E-mail frequency

Benton- 17 at least once a week, 2 almost every day, 1 a few times a month

ME- 17 at least once a week, 3 almost every day, 12 just few times, 7 only once (2 at ME complained that their Benton keypals never responded.)

Initial attitudes and stereotypes

Benton re Chicago/ME: Chicago was seen as full of crime, violence, and gangsters. "All people from the north are in gangs."

ME about Benton: "very big accents", "Beverly Hillbillys", "stupid", "a million farms", "nothing there", "wear overalls, with shirts that are torn", "all of Illinois like Chicago."

Pre-existing bias

Benton: No bias—13, Some bias—5

Most mentioned religious pluralism as acceptable. Two who admitted bias attributed it to ignorance "I wasn't really for sure about them and didn't have a good understanding". Other bias was religious (mentioned Buddha), and immigration: "I think that people from their countries should stay there."

ME: No racial bias—34, Some racial bias—2

Many statements affirmed values of multicultural tolerance and diversity: "None no!! I live in a diverse community." Only one boasted (?) of being a "racist".

Perceptions of self

ME: " ... I thought that they would think that were weird because we have different ethnics here"

Final attitudes towards other students/outgroup (10, 12)

Common response in positive intergroup contact situations: "they are just like us" Many statements unsurprisingly described positive attitudes towards the keypal, rather than generalizing to "people" in the region:

Benton- 5 more positive, 0 more negative, 13 no change

Positive attitude changes were seen in responses like: "I felt pretty close to the students I communicated with because they were very common with us." [more positive] "because some of them lost their family members in shootings". ME students were described as "pretty cool", "nice", "just like us". "I liked how they were from different cultures." A number described the experience as "exciting". One student who reported no change in attitude said, "We never really got to know them."

ME- 25 more positive, 2 more negative

Statements frequently reflected positive attitudes towards the keypal: "They were both good kids and I liked them a lot ", "I felt good taking to a friend that was miles away from me." Some could be referring to the whole regional outgroup, however: "I felt that they were nice people.", "Nice and honest", "normal". The most frequently remarked discovery was that the regional outgroup was "just like us."

Many mentioned a change in attitude: "They changed positively, because they are a lot like us and I hadn't known this." "Yes, because I found out they weren't Beverly Hillbillys." But not all attitudes changed: "No, because I kind of knew that they lived that way because they lived on a farm."

The two negative questionnaire responses involved the keypals looking "immature" and frustration at their partners' not responding. The essays revealed more negatives; however, describing people as "closed-minded", "old fashioned". One wrote: "I think the people or student down in Benton are mean hicks. They give attitude in there e-mail. Never write back. I think there like that because nothing ever exciting happens down there."

Some statements reflected ambivalence about the experience, again frequently due to frustration with CMC problems: "It was kind of fun talking them but at the end it started to get boring because sometimes our e-mails wouldn't go through and we had to type it again". "They are okay, some are a little weird or boring but still positive because I learned about them"

Final attitudes towards region

Benton: More positive = 1, more negative = 2, no response = 1, change = 5, No change = 7

One positive comment was: "That place would be nice to live in. Main East is a positive place with few negative things." One declared s/he wouldn't live in Chicago. Some said that they had changed their negative impressions, mostly about crime and violence: "Yes, my feelings about the town changed. I did think mostly of violence up there but it's not like that." Most, however, admitted they hadn't "talked much about our town." Some had no change in attitude: "I pretty much knew."

ME: More positive = 9, more negative = 4, no change = 12

ME: Change = 15, no change = 15 (mainly due to lack of preconception)

Some were pleasantly surprised: "I think its not that bad living in a farm, they still act like a normal kid." Some were attracted to the life-style: "I think that hunting, farming, fishing, and stuff like that is very relaxing and I would not mind at all to go live there." Positive traits mentioned were that Benton was "quiet" and "safe" (no gangs) with "more space" and that people were "friendly."

Even after putting the best spin on one's community from a community research project doesn't guarantee a tourist draw: "I still won't live there, too farming." "there town sounds weak, boring". "Yes, it sounds like it quiet area. Not of lot of thing do down there". "Well they don't have alot of good things down their when they e-mailed me, they told me that this town is pretty boring and not much happens here." Benton was "boring", "quiet", whereas Chicago was "active", "loud". A frequent comment was the lack of ethnic diversity in Benton, a major concern to the heavily minority Chicago students: "I still think Chicago is a better place to live because there are lots of people that have the same background as me. If I went to Benton I would be lonely. I need to talk to somebody my language too."

Final ME essays still display a surprising amount of stereotypes: "I think people who live their always wear overalls with a long piece of grass in their mouths. And they have pigs as pets instead of dogs or cats." "I think people down in Benton are old-fashioned too. I haven't had time to look at their pictures or read many of their letters, but this is what I think." "I think the people out there are probably disciplined because they would have to do allot of farming to survive. I also think the people are very poor and that there are allot of bums. There also probably no fancy restaurants out there to have a nice family dinner." And these responses from students who communicated frequently! Telling were the occasional uses of "probably" and "maybe", implying speculation.

Even those with the most positive attitudes, however, still preferred Chicago over Benton due to greater variety of activities.

Visit

"Would you now be interested in maybe visiting some of the communities and students in Illinois you learned about in Project I-57 during this school year?" (Question reflected attitudes toward the area rather than just the students.)

Benton re Chicago: Yes 20, No 0

Many expressed strong excitement: "very much so!!!!!!! Please !!!!"

Chicago (ME) re Benton: Yes 23, Maybe 2, No 14

Only one listed a negative perception: "No, because their area is very dull, quiet , and it's a small town". However, there were many positive reasons: "Yes I would be interested because I talked to them and they seem really cool " and "Yes, I learned a lot about them and it was really interesting."

Perceptions of ethnic difference

Benton about ME: Yes = 12, No = 0

Understandably, the mostly white B students remarked on the variety of ethnicities and religions of the ME students as well as their accents.

ME: Yes = 14, No = 5, Didn't know = 9

Three mentioned religious differences (Benton students were "Christian"), four mentioned racial sameness "They were all white" (very frequent response) One essayist wrote: "The people who live there are all mostly white, and same religion. They all talk the same way. I know this because of the pictures they have took. I didn't see not even one Indian, or black, or Chinese, just white." The multicultural classes at ME were a surprise to Benton students: "When they got to know how we have different people from all around the world they were really exited [sic]."

Differences

Benton re ME: different religions, nationalities, complexion, dress

ME: Age, age-related activities, (Southern) accent, bike-riding, go-karts, hunting, using guns, urban vs. rural, lack of ethnic diversity (white)

Commonalities

Benton: sports, hanging with friends, TV, both religiously devout,

ME: Sports, hanging out, movies, similar styles, cars, music, pets,

Main E-mail topics (some were assigned)

Benton / ME: Home/family life, community/where I live, school, school violence, hobbies, how they live, activities, sports, their community, my perfect weekend, future jobs

A few also mentioned unique regional topics: Benton caves, farming (no mines?). Only one mentioned a more controversial topic, religion.

Fisher Grade School- (Notre Dame High School)

Fisher n = 20 (8 male,12 female), ages 10-11
Ethnicity: 17 white, 2 Native-American, 1 mixed-race
Birthplace: US (all)
Language at home: English (all)

E-mail frequency

3 several times, 3 once, 14 never

Initial attitudes and stereotypes

Chicago was seen initially as dangerous with gangs and robbers, where you can "get killed for your shoes". "the people are rude, obnoxious [unclear] and are unpatient" and "troublemakers". It was also noisy, congested, and busy. On the plus side, it is "exciting" and "fun" with shops, landmarks, attractions, and professional sports. "People of all different kinds, blacks, whites, chinks, Japans, robbers." Many, however, admitted that there were both "nice" and "bad" people there.

Perceptions of self

Fisher is a better place to live because it is small, quiet and safe.

Final attitudes towards other students/outgroup (10, 12)

Attitudes were generally more positive, seeing the suburban kids as "normal" and "nice". "Most of the people I talked to were very nice." I think that the people are a lot better than I thought." But personal contact influenced both ways: "Most are O.K. but some are snobs." The experience can be transferred to the entire population: "I think the people in Chicago were stuck up."

Perhaps due to the high number who had no CMC contact, outgroup perceptions stayed very general and impersonal: "Some are bad & some are good." "I have no probrolem [sic] with them. I think have [sic] of the homeless people are just trying to find a place to sleep." Indeed, many essays didn't even mention the other student group or individuals in it.

Final attitudes towards region (13)

Many of the same general observations are found as in the pre-survey essays: Chicago is crowded, noisy, crime-ridden, etc. It also has shops and attractions. But most were able to find both good and bad points to mention in the post-survey essays.

Most still held a positive attitude towards their own town for its friendliness, small size, quietness, lack of traffic, safety and lack of gangs.

Perceptions of ethnic difference (11)

Knowledge is slightly more accurate: "I know now that there are a lot of different ethnic and religious groups." "All I know about the people that live there are there are lots of different religons [sic] and lots of different backgrounds like there [sic] color ...."

Conclusions

From the virtual intergroup contact experience of Project I-57 interpreted within the CF framework, certain preliminary recommendations can be offered for future CMC projects:

- Intergroup contact via CMC technology needs to be frequent and substantial enough lest insufficient interaction time leads students to prematurely "fossilize" their partial knowledge and attitudes in a simplistic, sometimes negative form resistant to later amendment. If students have been led by instructors to believe the planned intergroup contact will teach them about other geographic regions and the people who populate them, they may falsely assume they have learned all there is to know no matter how little the actual exchange of information was.

- Coordinators should frequently monitor students for frustration with secondary problems such as technology glitches and lack of keypal response to minimize negative experiences that may transfer to negative attitudes towards the other group.

- Good relations and attitudes towards individual outgroup members who participate in the collaborations may not necessarily extend to other outgroup members (not generalized) unless sufficient context is provided. There was a surprising amount of self-confessed ignorance in the post-survey essays about the wider communities and populations the other CMC participants came from and repetition of old stereotypes. To counteract this, the Web sites on each community could have included information on a greater variety of local citizens in addition to city landmarks. Due perhaps to the distance, it was not hard to maintain distinct dual group identities during the period of contact (one theory-based recommendation (G&D)) but perhaps the outgroup was never contextualized enough for such transfer of attitudes.

- Although the two sides of a CMC contact situation may be theoretically conceived of as two homogeneous ingroups, the reality may be more complex, with intergroup tensions even on one side of the communication situation. Educators, therefore, should try to create as much "team" cohesiveness on their own end before engaging virtually with the team on the other.

- To maintain as much status equality as possible when planning a grant proposal, it is best for CMC partner groups to be of equal ages (HS paired with HS, etc.) due to commonality issues such as social maturity, interests, etc. Inescapable status inequities, however, can also be balanced successfully, as with the lower status younger Southern Illinois group (yet socially white middle class and native-born), who were paired with higher status urban students, socially middle- to working-class in special at-risk classes. This is not optimal according to the Contact Hypothesis, yet it is a manipulable variable. In addition, status bias can be reduced by encouraging each group at the beginning to recognize mutual superiorities and inferiorities --complementary forms of expertise.

- CMC activities should be *collaborative* and of practical value and aim to decrease *competitiveness* to create positive intergroup attitudes and reduce bias on each side. The community research activities in Project I-57, while not collaborative, were of obvious authentic and practical value to each community, thereby increasing feelings of local self-esteem and personal expertise while at the same time not encouraging competitive comparison between communities.

- Geographic distance lessens feelings of threat and anxiety from contact, which validates distance CMC projects like Project I-57. Therefore, the more distant the groups, the less threatening the intergroup contact should be. Geographic proximity, however, even if mainly through virtual contact (e.g. Maine West and Iroquois HS, both Chicago schools), may carry greater threat because the competition and conflict is pre-existent.

- The level of original positive/negative attitude is another determining factor in how contact should be planned. When groups are in historical or immediate geographical competition, increasing group members perceptions of common ingroup identity is the only realistic strategy for reducing bias". Affective priming (e.g. starting by watching a comedy) is strongly advised against.

Supporting Web Sites

I-57 Project site: http://lrs.ed.uiuc.edu/i57/

Student essays and demographic data: http://lrs.ed.uiuc.edu/i57/PSessays.html

Formative mid-project evaluation (12/98): http://lrs.ed.uiuc.edu/i57/Paul/eitevalproj.fin.html

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A Model for Pedagogical and Curricula Transformation with Technology

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Key Words: staff development, contextual barriers, instructional technology, pedagogy

Introduction

The purpose of this study was to investigate the factors that influenced five middle teachers as they implemented and integrated instructional technology in their curricula. Along with determining the effects implementation and integration of instructional technology had on their pedagogy and curricula. The study involved empirical research with both qualitative and quantitative data. Data analysis included a cross-case analysis of multiple case studies. Data were gathered August 1999 through December 1999. This time period was selected because it provided the opportunity to test the ST^{3}AIRS Model in a school setting from the beginning process of implementation and integration of a new technology.

Why is it difficult to implement technology in schools?

The availability of instructional technology for teachers is increasing in middle school science to meet societal demands and goals. Society's goals include the use of instructional technology as part of everyday instruction in school to prepare children to meet the needs of an increasing technological dependent culture (ISTE, 1998). These goals include the implementation and integration of instructional technology to facilitate the teaching and learning process through curricula transformation. However, teachers have not rushed to change their classroom instructional strategies or shift their pedagogical practices to include instructional technology. This transpires in spite of increased accessibility to better hardware and software, along with an increase in staff development opportunities (U.S. Congress, Office of Technology Assessment, 1995). Teacher resistance to change is primarily due to their concerns regarding the influence of instructional technology integration on their preparation, beliefs, and values. These concerns include teacher technical ability and proficiency with instructional technology, along with organizational culture and climate influences that are beyond the control of the teachers (Dexter, Anderson, & Baker, 1999). These concerns include the influence of their school climate and culture facilitating or presenting barriers (U.S. Congress, Office of Technology Assessment, 1995; Becker, 1991).

Becker and Riel's (1999) research found that the work of integrating instructional technology strategies into practice is a complex process and that teachers encounter either a bureaucratic culture or a professional culture in their school. Bureaucratic cultures tend to give teachers autonomy in their classrooms, but restrict their participation in curricular and organizational decisions. The bureaucratic culture hinders innovative practice and collaboration among teachers. In contrast, professional cultures support innovation and collaboration among teachers. In this culture, decisions are based on a guiding philosophy about teaching and learning and sensitivity to the learning needs of students. In previous research, Becker (1991) found that only 5 % of technology implementation programs succeed beyond a three-to-five-year period in schools.

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Background

While National Education Technology Standards for Teachers (ISTE, 2000) provide goals for teachers that are not all-inclusive, instructional technology has strongly influenced the education is taught in the United States. The use of technology in education has grown out of the personal experiences of teachers and students, along with the need for instructional technology to support national standards in science, math, social studies, and language arts.

Contextual Barriers to Change

A major challenge to educational innovation is assisting teachers in unlearning the beliefs, values, assumptions, and culture that underlie their school's standard operating procedures and practices (Dede, 1999). To be successful beyond initial implementation, school systems need to assist teachers in learning, but also aiding them in unlearning their standard organization's operating procedures. The goals of the innovation implementation must include organizational changes as teachers learn. A shift in organizational change will sustain change that can only be achieved when owned by teachers and not imposed or mandated (Dede, 1999).

Figure 1 illustrates common barriers to the use of instructional technology. These barriers include time, funding, rationale for use, training and support, apathy, teacher involvement, vision, access to hardware and software, and adequate assessment practices. Of those illustrated, research by the U.S. Congress, Office of Technology Assessment (1995) indicated that time is the greatest barrier to teacher's implementation and integration of instructional technology. The time barrier is supported by the many demands on a teacher during the course of a school day, with little or no time allotted to explore instructional technology, collaborate with other teachers about applications of this technology, and integration of the technology into their teaching strategies and techniques.

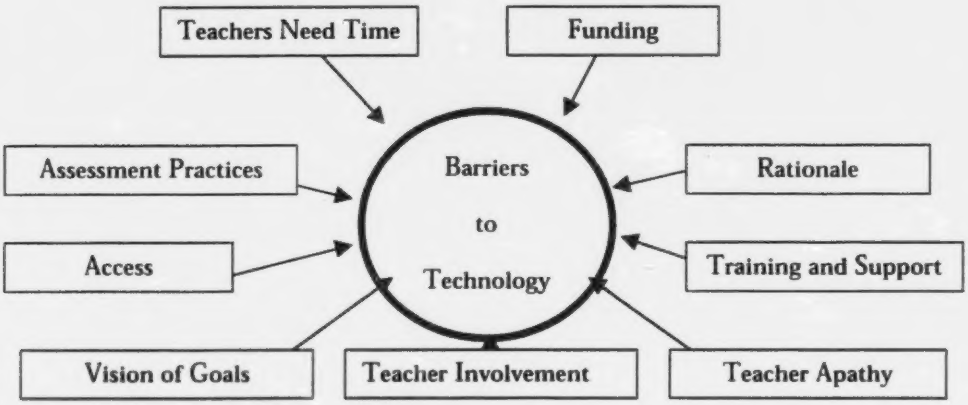

Figure 1: Common barriers to teachers using instructional technology.

Note. From the U.S. Congress, Office of Technology Assessment, 1995.

Overcoming these Contextual Barriers

The challenge of integrating instructional technology is not only providing assistance to teachers to learn how to operate a technological tool; it is helping them to learn to integrate the technology tool in their curriculum. To effectively integrate the use of this technology, several approaches will ease the concerns of teachers, increase the level of use, and provide examples of best practices for changes in teaching strategies. These approaches include training master teachers, providing expert resource assistance, providing adequate staff development for teachers, providing staff development for administrators, and establishing technology training centers within the school districts (Ravitz, Wong, & Becker, 1999).

Although the problem of instructional technology integration has many solutions, the best appear to be in making time for staff development and providing support for teachers. Instructional technology takes time to master. Hardware and software, no matter how "user-friendly," require time to master. As in any profession, time must be invested in learning how to use an instructional technology tool before real integration in curricula can occur. Figure 2, adapted from U.S. Congress, Office of Technology Assessment (1995) illustrates the requirements for effective use of technology.

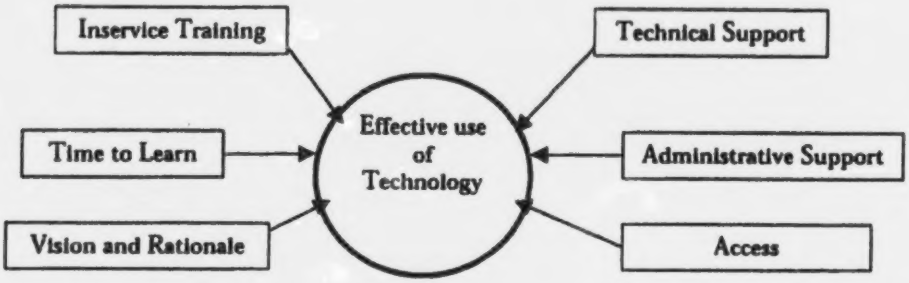

Figure 2. Requirements for effective use of instructional technology.

Note. Adapted from the U.S. Congress, Office of Technology Assessment, 1995.

Literature Review

The literature regarding implementation, integration, and transformation is broad-based with respect to instructional technology. The broad-based literature does not adequately represent the specific underlying concerns and changes teachers make in the integration and the ultimate transformation of their pedagogy. The findings of this study provide supporting research in this area with an in-depth analysis of factors that influenced five middle school science teachers.

Standards and Instructional Technology

The integration of instructional technology in schools is a fact of life in American education. Along with integration, the ability of students to use instructional technology is recognized as an essential skill by society. Recognizing the responsibility to prepare students to work and live in a technological society, national education standards recommend integration of instructional technology in teaching. These standards include the *National Education Technology Standards for Students* (ISTE, 1998), *National Education Technology Standards for Teachers* (ISTE, 2000), *National Standards for Social Studies Teachers* (NCSS, 2000), *National Science Education Standards* (NRC, 1996), and *Principles and Standards for School Mathematics* (2000). Position statements by the Nation Association for Education of Young Children (2000) and National Council of Teachers of English (2000) provide guidelines for the use of instructional technology in teaching. These standards and position statements advocate the use of instructional technology by teachers to encourage students to become active participants in the learning process.

Teachers' Beliefs and Change Regarding Instructional Technology

Although teachers have the advantage of an unprecedented amount of instructional technology for use in their classrooms and schools, little evidence indicates that teachers systematically integrate technology in their classroom curriculum. Several factors erode efforts by school districts or schools as they make an effort to sustain an effective technology program. Factors that influence their efforts include a focus on hardware rather than on implementation processes, a weak implementation planning process that fails to meet the needs of teachers, and little or no professional staff development. To be successful with technology implementation, teachers need to change their pedagogy. This teacher change is a process that requires a shift in a teacher's paradigm as he or she implements a new innovation that has an influence on their pedagogy (Dexter, Anderson, & Becker, 1999).

Change is a process that may span a period of years and the recognition of this process by those concerned during the implementation of a new instructional strategy or technological tool is important. Individual teachers can accomplish change, but only when these teachers take ownership in a new instructional strategy or technological tool will sustained change take place. This change may take two to three years for a new technology tool to be fully implemented and integrated within a curriculum.

Teacher Change

Change is a personal human experience that needs to be considered by school systems and change facilitators when implementing a new program. To successfully implement the integration of a new technological tool, consideration of what the implementation will mean to teachers' personal beliefs and values is of great concern. How will it affect their current classroom practices, preparation time, beliefs regarding technology, and values? What factors directly and indirectly influence teachers' integration of instructional technology (Dexter, Anderson, & Becker, 1999)?

Teachers' beliefs and values regarding change that are incompatible with the implementation and integration of a new instructional technology tool are a major obstacle. For these teachers to accept change in their pedagogy to adapt a new technological innovation, they must first experience conflict within their expectations. For teachers to conceptually change their teaching strategies and techniques, they need to (Posner, Strike, Hewson, & Gertzog, 1982): become dissatisfied with their existing conditions; view change as intelligible; view change as plausible; and find change useful in a variety of new situations.

Through time teachers have developed resilient teaching practices, due to ever shifting goals and policies that influence their pedagogy. To accommodate this process, teachers look for and use reliable teaching strategies effective with large groups of students in small places. They must be convinced that new strategies are efficient and effective.

To effectively understand the process of teacher change, one must adhere to the premise that a teacher becomes a learner. Teachers who want to change are teachers who want to grow and do not believe in the status quo. Teachers who are reflective are continually trying to do what is best for their students. Schubert and Ayers (1992) contended that only reflective teachers continuously grow.

In their research involving 608 teachers, Buck and Horton (1996) found that teachers believed their teaching had been transformed by the integration of instructional technology in their curricula. These teachers' perceived changes in their pedagogy resulted in more complex material and concepts for their students, that their students needs were met, and that they had shifted from teacher-centered to student-centered instruction.

Teacher Beliefs and Values

A teacher's epistemology is a product of his/her own prior knowledge, development, and experience as teacher. Each teacher's teaching style is influenced by personal factors, including his/her personality and belief system. But all teachers' styles are influenced by the context of the organizational structure in which they teach. For instructional technology to be successfully implemented, teacher beliefs and values need to shift. If not, the desired implementation and integration of instructional technology in education will not occur on a broad scale

From a Vygotskian perspective, humans develop and change as they interact with others and learn to make use of a culture's tools, both physical and psychological. So the constructions that humans make in their minds originate in interchanges with people and influence their beliefs and values. The transformation from the inter-psychological to intra-psychological takes place within a person's "zone of proximal development (ZPD)" (Vygotsky, 1978). Because the teacher is a learner when implementing and integrating an innovation, the teacher who is an expert becomes a novice. In learning new teaching strategies, a teacher's ZPD is concentrated learn new things that may conflict or support their beliefs and values. Since much of teacher change is revolutionary, teachers need time to reinforce and deter resistance to change. Martin (1993, p. 84) argued that "Without time and support for constructive interaction, there is no chance that the teacher will appropriate the new information."

Theoretical Framework

The framework for this study was the ST^{3}AIRS Model (Figure 3). Through this framework pedagogical support and technical assistance was provided during the study period.

ST^{3}AIRS Model consists of eight steps developed to overcome contextual barriers to teachers as they integrated technology. These eight steps are staff development, time to learn, trainer that was qualified, transition time to implement technology, access to hardware and software, involvement by teachers in the process, recognition of teachers, and support for teachers. The ST^{3}AIRS Model focused on strategies for the implementation and integration of the teachers involved in the study to influence changes in their pedagogy, along with curricula changes related to the implementation and integration of this technology. Research by Dexter, Anderson, and Becker (1999) found that contextual barriers influence instructional practices, teaching strategies, classroom management, technical expertise, curriculum directives, and organizational support for teachers. Support for the teachers involved in the study included staff development sessions, technical assistance, support for modifications of laboratory lessons and techniques to improve student learning, and problem solving strategies and techniques to support integration.

Methodology

The study was an empirical multiple-case design that used the dominant-less dominant qualitative-quantitative approach to eliminate misleading associations (Creswell, 1994). As part of this approach, descriptive numeric methods were used to analyze quantitative data. Cross-case analysis of the five teachers in this study, allow conclusions that are drawn from the findings in relation to the research questions and are constructed into a rich understanding of influences on these teachers from a personal perspective. Using larger numbers of teachers may replicate previous findings and add little beyond existing literature. Additionally, a larger number of teachers would limit the study's ability to conduct an in-depth analysis of influences that these

teachers encountered as they integrated instructional technology. Also, a larger group could limit the study's ability to obtain the teacher trust and confidence.

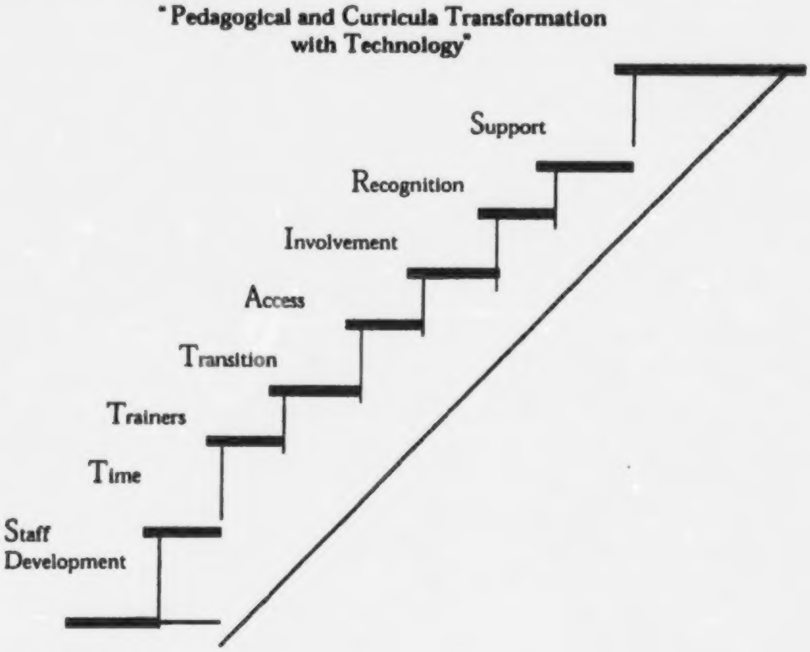

Figure 3. ST^{3}AIRS Model.

Overview of the Site and Sample

The teachers in the study were all in a middle school located in a suburban community of Virginia. The school was in a predominately middle to low socioeconomic setting. The school system was small having four elementary schools, one middle school, and one high school. The middle school's population was approximately 750 students ranging in from grades six through eight. Ethnic make up of the school was 70% European American, 20% African American, 5% Hispanic, and 5% other minorities. Approximately 30% of students enrolled in the school were eligible for the free or reduced lunch program, and less than 10 percent of the school's student population was considered transient. All students were enrolled in science, which was one of the core content requirements for each respective grade level in the school.

Teachers

The teachers involved in the study were science teachers either full or part-time, and only one was a science major. Mathematics was the second content subject taught by the teachers who were part-time science teachers. Science content consisted of sixth-grade general science, seventh-grade life science (introductory biology), and eighth-grade physical science (introductory physics and chemistry). Five of the nine science teachers in the school participated in the study. Two were sixth-grade science and teachers, one was a seventh-grade science teacher, and two teachers were eighth-grade science teachers. Table 1 provides selected demographics of the participants.

Table 1: Selected Demographics of Study Participants

Teacher	Years [1] Teaching	Grade Level	Years in [2] Leadership	Level [3] of Technical Proficiency	Technology [4] College Credits	MS [5]	Ethnic Origin
1	11	8	0	II	8	No	European American
2	26	6	10	II	9	No	European American
3	21	8	2	I	9	Yes	European American
4	23	6	1	III	6	No	African American
5	33	7	0	I	6	Yes	European American

1. Years of teaching experience.
2. Leadership as a science department head, state organizations, or team leader.
3. Current level of Virginia Teacher Technology Competency Certification.
4. Instructional technology credits completed in higher education.
5. Master's degree.

Research Questions

The following questions provided the focus regarding implementation, integration, and curricula transformation of CBL probeware by the teachers involved in the study:

1. What were the middle school science teachers' concerns regarding implementation and integration of technology?

2. What changes in teaching strategies and techniques did these middle school science teachers make when implementing and integrating technology?

3. What were the strengths and weaknesses of the ST^{3}AIRS Model?

Data Collection

Three interviews of each teacher were conducted to collect qualitative data in relation to technology implementation and integration. These three interviews were the Initial Teacher Interview, Levels of Use Interview, and Final Teacher Interview. Quantitative data were collected using three instruments from the CBAM Model (Hall, 1974). These three instruments were used to collect data regarding the integration of technology and included the Stages of Concern Questionnaire (SoCQ) regarding the use of an innovation, the Levels of Use (LoU) of an innovation, and Innovation Configuration (IC) regarding the actual implementation and integration of an innovation (Loucks & Hall, 1979). Figure 4 provides a timeline for data collection during the study.

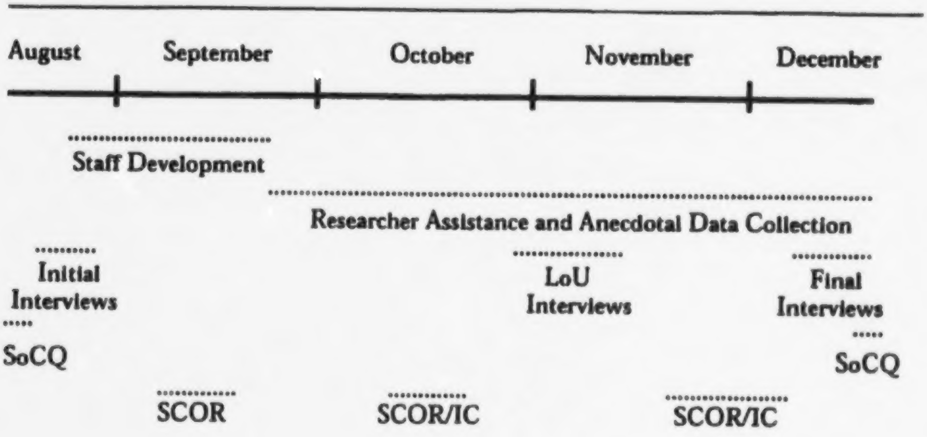

Figure 4. Data collection timeline August- December 1999.

Data Analysis

Data analysis was an ongoing process, beginning with the first interview. Initial data analysis was through the use of individual case studies of the five teachers using interviews, questionnaires, and observations. After analysis of each case study, a cross-case analysis was conducted on the case studies looking for common patterns. Triangulation of data used multiple sources of data to reduce researcher bias and provide a better assessment generality of the findings and conclusions (Creswell, 1994). These multiple sources of data included interviews, questionnaires, and observations as part of the triangulation approach. Interviews provided insight into the teachers' personal experiences during the technology implementation and integration process.

Findings

General conclusions can be drawn from the evidence of this study through case study findings and cross-case analysis of the data. The following general conclusions are presented through the framework of the research questions.

Research Question 1: What were the teachers' concerns regarding the implementation and integration of technology?

- Four of the five teachers had a meaningful decrease in their concerns in relation to their awareness and information regarding their integration of this technology.
- All five teachers were concerned with limited hardware resources that restricted the collaborative efforts of the teachers to integrate this technology in their curricula.
- Four of the five teacher's concerns with the implementation and integration of this technology were substantially reduced by giving them ownership of the process.

Research Question 2: What changes in teaching strategies and techniques did these middle school science teachers make when implementing and integrating technology?

- Four of the five teachers had a shift in their teaching strategies and techniques in relation to this technology integration, which provided evidence of short-term transformation in their pedagogical practices and curricula.

- Four of the five teachers used a student-centered approach when using this technology with their students. Which was a shift in pedagogy for three of these four teachers.
- Four of the five teachers' views and beliefs regarding their concern with the appropriate use of this instructional technology in middle school science shifted from nonsupport to support.

Research Question 3: What were the strengths and weaknesses of the ST^{3}AIRS Model ?

- Collaboration among the teachers in the study and a sense of partnership with the researcher were instrumental in the successful short-term transformation of pedagogy and curricula by four of the five teachers.
- Staff development sessions that allowed the teachers to explore the technical aspects of CBL probeware and how it fit within their curriculum, before implementation.
- Support before, during, and after classroom implementation of technology by the teachers.
- Teachers were allowed to select the time and curriculum integration point without a sense of pressure to integrate this technology before they were ready.
- Involvement of the teachers in all phases of the implementation and integration process.
- There were no weaknesses noted by participants in the study.

Limitations and Considerations

As with all studies, there are limitations in the research design. One limitation of this study was the small number of teachers, which was five teachers. Even though there were only five teachers, their number provided in-depth findings and conclusions of the data. This limitation of five teachers does not allow the findings of this research to be generalized and are confined to the conclusions within the context of this study. However, with consideration of the contributing to the body of literature regarding this research, the findings of this study can be generalized within a similar context.

While caution must be used in generalizing the experiences of these teachers to all middle school science teachers, the study indicates that within this context there was an 80 % success (i.e., four of five teachers) for short-term pedagogical and curricula transformation. This 80 % success rate exceeds the findings of research completed by Becker (1991), who found that only 36 % of teachers were willing to transform their pedagogy and curriculum to include instructional technology.

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A Picture of Change in Technology-rich K—8 Classrooms

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Abstract

This qualitative study reports on Arizona Classrooms of Tomorrow Today (AZCOTT), a component of a Preparing Tomorrow's Teachers to Use Technology project. In conjunction with five partner school districts, Arizona State University West developed five technology-rich K-8 classrooms to serve as models for preservice students and university instructors. This study report describes changes occurring as the AZCOTT teachers learn to teach in technology-rich classrooms. Changes are described in teacher practices and student attitudes. Factors supporting change are discussed. Finally, the researchers discuss the progress made toward using these classrooms as models for preservice students.

Only a small percentage of K-12 teachers use technology on a regular basis with children in their classrooms (Becker, 2000). At the same time many Preparing Tomorrow's Teachers to Use Technology (PT3) projects are attempting to identify technology friendly classrooms for preservice student internships. Ideally, teacher education programs would like to place preservice students in practica situations with exemplary teachers who provide the environment for K-12 students to use technology as part of their everyday lessons. However, such placements are not commonly available. According to the director of field placement at Arizona State University West, we lack school sites for field placements where our preservice students can observe exemplary technology integration practices in K-12 classrooms (Carlile, 1998). Each semester 800 students are in field placements in the ASU West program and the placement office simply lacks the technology-rich classrooms needed to accommodate the students. The AZCOTT program was designed to help create exemplary placements for our students. This research project focuses on the teachers and children in the AZCOTT classrooms, and the changes that occurred as the AZCOTT teachers learn to teach in technology-rich classrooms.

Characteristics of Exemplary K- 12 Technology-Using Teachers

Becker (1994) analyzed national survey data to identify exemplary computer-using teachers. Out of a sample of 516 third through twelfth -grade teachers, 45 were identified as exemplary. Factors that contributed to exemplary computer use among those teachers were: opportunities for collaboration, attempts to make computer activities consequential, access to staff development activities, and fewer students per computer in their classrooms. In addition, he concluded that exemplary computer using teachers were more likely to emphasize small-group work. Although the factors that Becker (1994) identified were in the context of classrooms, schools and districts, the same factors can be considered in the context of individual teachers in separate schools working in collaboration with a university, as is the nature of the AZCOTT teachers who are the subject of this paper.

Implementing Change in K- 8 Classrooms

Buying technology for K–12 classrooms is expensive, but a relatively straightforward procedure. Much more difficult is changing the way teachers teach so that they use technology effectively, and even more difficult is changing teacher pedagogical beliefs that drive their choice of instructional strategy (Fullan, 1991). Moreover, the implementation of technology is problematic because it is not one innovation, but a combination of many related innovations, for example, hardware and multiple computer applications (Hall & Hord 2001).

In this study the authors will describe AZCOTT, a component of ASU West's Preparing Tomorrow's Teachers to Use Technology Project (PT3), and the changes occurring as experienced elementary teachers learn to teach in technology-rich classrooms and as the PT3 project leaders attempt to use the AZCOTT teachers and their classrooms as models for preservice students.

Program Description

Technology-rich K–8 classrooms that serve as models for preservice students and district teachers. Five college of education instructors participated in at least two days of the AZCOTT training along with the K–8 teachers. These instructors as well as the student placement coordinators encouraged preservice students to observe in or select these classrooms for practicum experiences.

AZCOTT teachers were selected through an application process. Teachers applying to participate addressed key questions about potential K–8 student use of technology in the classroom. In January 2000, children began participating in five AZCOTT classrooms. In addition to the technology already in their classrooms, these teachers each received 4-5 multimedia computers with Internet access, software, a projection system, and technical support from their school district; as well as more than 100 hours of training from the PT3 project.

The training consisted of an initial two-day workshop followed by four half days of training throughout the semester and three days in June. The curriculum addressed new technologies and creating and implementing curricular units called Units of Practice (UOP) (Sandholtz, Ringstaff, & Dwyer 1997) that integrated technology into elementary content areas. Participant's UOPs and the rubric can be viewed at http://azli.asu.edu. Time was also provided to share ideas and reflect on practice. Between sessions, participants communicated using an online conference. The second semester of training began in September 2000 and consisted of every other month half-day meetings and participation in a graduate course on using the Internet in the classroom. Preservice students were invited to participate in these classrooms after the AZCOTT teachers completed the first semester and summer of training.

Methodology

Using qualitative techniques, the authors describe changes resulting from the teachers' participation in the AZCOTT program.

Subjects

Five teachers, one from each university school district partner, were selected to participate in the first cohort of the AZCOTT program. These teachers were initially selected because it was thought that they would provide exemplary models of technology integration for preservice teachers and district teachers. A brief description of each classroom follows.

Mr. B taught 27-second grade English as a Second Language learners in an urban inner city school where all of the students are receiving free or reduced lunches. He was a technology mentor for his school helping other teachers with technology before and after school.

Ms. Lo taught 120 sixth graders science and language arts in an urban school with 35% of students receiving free or reduced lunch. She was a technology mentor for her school.

Ms. T taught 110 seventh graders mathematics and pre-algebra. Fourteen percent of these students were receiving free or reduced lunch.

Ms. Li taught 31 fourth graders in an urban elementary school with 50 percent receiving free or reduced lunch. She is a technology mentor for her school.

Ms. V Taught 100 seventh- and eighth-grade, gifted students in urban schools with few students receiving free or reduced lunch.

Data Collection

The data for the study came from multiple sources. First, during the AZCOTT workshops participants shared their questions, concerns, curricular ideas, and implementation attempts. These teacher reflections and discussions were audio or videotaped and transcribed. In addition participants participated in a FirstClass online conference that provided support as they implemented technology use in their classrooms. Between each workshop session participants used this online conference to react to selected chapters in *Teaching with Technology* (Sandholtz, Ringstaff, & Dwyer 1997) often comparing their situations to those described in the chapter. These messages were aggregated using a summarize feature of FirstClass, printed and analyzed. Although the transcriptions and the online dialogs were the major sources of data, other sources supported the themes identified, for example, the written report of an external evaluator, video vignettes taken in each classroom of the AZCOTT teacher and students, and the impressions of the PT3 project manager who visited each classroom and took notes on her visits.

Data Analysis

Using the constant comparative method (Strauss 1987), data analysis began when data were first collected and continued throughout the study. The first and second authors independently read the transcripts and online conference printouts and identified patterns and categories. Subsequently they met to discuss patterns they observed in the data and questions that arose after the readings. After that discussion, the authors re-read all the transcripts and re-categorized the data. Each highlighted the portions of the transcripts addressing each category. They met a second time to compare the answers to the questions and the categories that arose as they read. They compared key categories and re-read the transcripts to see if the selected categories worked to describe the experiences of the AZCOTT teachers. The categories were: changes in teaching methods, curriculum changes, teacher leadership, teacher collaboration, student engagement, student noise, student disposition toward learning, student collaboration, and students as helpers and coaches. These categories were organized around two major themes: teacher change and student change.

Results

The data from selected aspects of the themes (teacher change and student change) will be reported in this section.

Teacher Change

The researchers found the following types of teacher change: change in teaching methods, change in thinking about curriculum (UOP), change in teachers' roles as leaders, change in the level of teacher collaboration, and change in the way the teachers communicate with parents. Using the actual words of teachers, teaching methods are addressed first.

Changes in Teaching Methods. As teachers became involved in the training, workshop reading and sharing with peers, they attempted to integrate technology in their classrooms. This led them to question their approaches to teaching. For example:

- What AZCOTT is forcing me to do is to look beyond what is comfortable and ask where and if my current practices fit and if they don't what can I do to alter them so that they do fit. I try to accept that I may not have all the answers and hope that I am flexible enough to accept any needed changes. Ms. T Gr. 7 math

- I was really insistent that people stay at their own station. Through some of the reading and things that we have done in this course, I now see more of the value of kids working together at stations and sharing together. I have seen a lot more peer teaching, so I am a little bit more open to that now. Ms. Li, Gr. 4

Changes in teaching methods included movement from a teacher-oriented approach to other approaches that involved student collaboration. This has induced a shift of focus in the classroom from the teacher as the provider of knowledge to the students as seekers of knowledge. Examples of this change are evident in the comments that follow.

- Instead of doing a lecture where I used to stand there and just give them scads of notes and they would all walk out grumbling, I give them the study guide research sheets and in groups they work to find the answers using the [computer] program. Ms. Lo Gr. 6
- "[While working on a house design project] a group of students.... insisted they needed a bowling alley in their house. What they found out was that they couldn't get it to fit. I did not [have to] tell them. It was a learning process. Exceptional, in terms of their own learning process. Ms. T, Gr. 7 Math

The teachers realize that this change in the classroom focus allowed the students more control in what will be studied.

- [The students] were able to come up with such neat stuff for me to teach this year and that was really hard for me to accept- my kids were helping me figure out what to teach. I turned some to the control over to them so they were coming up with different ways of doing it. Ms. Lo, Gr. 6
- I have started reading material about individual work stations and having students go through stations that will allow them to choose more of what their work will look like .... I didn't know how I could go from direct instruction to primarily student led instruction. Now I see it. Ms. T, Gr. 7 Math

Sometimes the change is simply doing a traditional assignment in a new way with technology, for example.

1. We did a character analysis on the characters in the story called the "Fisherman and the Wife." For each group I created a Hyperstudio template and then each group was just to type in the information about the character that they were studying. This was an alternative form of a book report. Mr. B, Gr. 2

The teachers express their interest in new ideas for using technology in their classrooms. They also build on the ideas of their peers.

- When I hear an idea I'm trying them out just as quickly as I can work with them. Mr. B, Gr. 2
- The creative problem solving part, I want to address that with a different view of the kinds of products and projects that I want to be the outcomes of student work. That is going to require me to take a look at alternative ways of assessment. Ms. Li, Gr. 4

Curriculum Change. The data revealed changes in both planning curriculum and in procedures and materials. This PT3 project incorporated the use of the Unit of Practice (UOP). The UOP has helped teachers to understand that technology for the sake of technology is not appropriate. It is the use of technology to support curriculum that is. For some of the teachers, this was a new way to look at technology.

- When we started…, I kept waiting for the technology to appear. Then I realized … that the focus was going to be… the curriculum, and that technology should always be a way to get to the curriculum. What is it that we want children to know and be able to do and how does technology help with that? Ms. V, Gr. 7 & 8 Gifted Program
- The technology was driving what I was teaching. The UOP has been able to help me to get the technology in where I needed it yet still keep the focus on my teaching. Ms. Lo, Gr. 6

Teacher leadership. AZCOTT teachers have seen the value of instructional technology and have taken leadership in finding and developing additional support for technology integration. They have demonstrated their leadership in PTA fund raisers, grant proposals, teaching of teachers, and in offers of positions of leadership.

- We have a PTA carnival to raise funds and we are doing a project called Fun Photos. The students will take photos of kids with the digital cameras, we will download them print them off on that nice photo paper and sell them. Ms. T, Gr. 7 math
- ….I have been asked to teach district classes now and I am teaching a district class called the Technology Toolbox and that's really been exciting for me professionally and it's just really – being on AZCOTT has been really built my confidence. Mr. B. Gr.2

The teachers seem truly excited about spreading the word about technology. In addition to their current involvement, they have also envisioned future avenues.

- I hope to be training our new teachers at our school about the technology we have at our school. In the future the computers and software need to become something that is open and available. Come get it. Mr. B, Gr. 2

Teacher Collaboration. The teachers realize that working as a member of a team has been a powerful experience. They value this collaborative opportunity, look for ways to increase collaboration within the group as well as outside of the group, and envision future ways of using it for the benefit of technology integration.

2. I guess the best part for me in being part of the AZCOTT project is being able to communicate, collaborate, and creative problem solve with all of you. What is interesting to me being a 7th and 8th grade teacher is the ideas I get from Mr. B who teaches 2nd grade and the ideas I can get from a 6th grade teacher and a 4th grade teacher. Ms. V, Gr. 7 & 8 Gifted Program

3. We are great resources for each other. I am tired of being the one in front of my staff all the time; it would be great if one of you guys would come over. We can be guest speakers for each other; there is no reason why we couldn't do that. Ms. Lo, Gr. 6

The AZCOTT teachers also thought about the benefits of involving other teachers.

- I've been going to other classrooms asking – How do you use technology? What do you use technology for? Could you give me some hints about how I could use it because I'm lost here? Ms. T, Gr. 7 Math
- Next year I see my classroom as being much more open to other classrooms on campus, doing a lot more team teaching, peer teaching with the other kids. I see a lot more planning collaboratively with other teachers. Ms. Lo, Gr. 6

Student Change

The researchers shared the teachers' discussions of their methods and curriculum. However, the teachers also discussed the student responses to this changing environment. The categories comprising student changes are student engagement, levels of classroom noise, disposition toward learning, collaboration, and willingness to help others. Listen to the voices of the teachers as they describe student engagement.

Student engagement. AZCOTT teachers describe students at work in their classrooms. For example:

4. Today I was watching students working in all corners of the room. While I was helping one (group of) students edit their animal report, I looked around and everyone was busy, helping each other with typing, getting ideas synthesized into paragraphs or finishing up poems and drawings for their reports. There was plenty of activity and noise, but everyone was on task. Ms. Li Gr. 4

5. I have students now getting involved that were not before. Ms. Li. Gr. 4

6. I see 110 seventh graders comfortable working with each other . . .. They became the experts. Collaboration was amazing between them....They are willing to take risks. They are on-task, engaged. Ms. T Gr. 7th math

7. We only have four days of school left. The kids are in a MathQuest .... Those kids are working ... they are so engaged. Ms. T Gr. 7th math

Student noise. Although, student conversations were integral to student active participation in projects, teachers revealed a general unease over the amount of noise in their classrooms. For example:

- It's a tremendous amount of conversation. The noise level is always up. I don't have a problem with that. It bothers some of my colleagues, so I have to deal with that, and I do. Ms. T Gr. 7 math
- I wasn't prepared for the noise level. I was not ready for the constructive arguing that was happening. It really made me go back and think about what I will do next time management wise. It is very difficult to manage the kids when they aren't used to doing it. Mr. B, Gr. 2

Student disposition toward learning. AZCOTT teachers discussed student desire to learn and willingness to contribute to the learning process. For example:

- The technology is a surprisingly natural tool, it didn't just come and appear to be one of those abnormal things that you're not going to use inside the classroom. The students actually were the ones to touch it first. They were the ones who wanted to discover things. Ms. T, Gr. 7 Math
- Students come up with ideas on how to use the laptops and software (Inspiration). They always go beyond what I asked them to do. Ms. Lo. Gr. 6
- Already the kids have said, "Well, you know, can we stay after school sometimes and do the extra work? Ms. Lo Gr. 6

Student collaboration. All of the teachers reported that their students worked together and helped each other. In the first example, Ms. Lo explains the social changes in her students over the course of the year.

8. I work with 6th graders and we all know that at that age being collaborative is not always a possibility, and liking everybody in the room is not always an option. So having five laptop computers ... with thirty students—that was going to require that they work with people. What happened initially, I got big responses " I don't want to work with him" or "I don't like her". As we progressed they started making choices of who they wanted to work with based on skills rather then who it was they liked ... I heard this group saying, let's ask him to come over here because he really knows how to use that program. They were recruiting people that they knew had the skills. That was something I totally did not expect to have come out of this. Ms. Lo, Gr. 6)

Other teachers shared similar findings.

- They often times come with a lot of technology knowledge. So it was really nice for me because when I need someone to walk someone through a PowerPoint presentation they could and they were better at it than I was. The kids were so comfortable with each other doing that so it didn't set up a "I am going to teach you" kind of situation, it was a real exchange of two peers. Ms. T, Gr. 7 Math
- The collaboration was amazing, the kids were willing to help each other. We did videotaping and you could just see kids get up when someone asked them a question and go right over and help someone in a non-threatening manner. It was just exceptional! Ms. T, Gr. 7 Math

In these examples students were spontaneously helping each other, but also students who were placed in groups or who self-grouped in ways that worked harmoniously.

Students as helpers and coaches. In the next instance, Ms. V explains that students can help teachers by creating multimedia projects and by trouble shooting technology problems with teachers.

9. Exposing students to technology and its effective use as a communication tool has allowed them then to go back and do projects for the teachers. And they ask teachers, "Can I use PowerPoint to do this, can I do a graph on the computer, can I use the Internet for this particular purpose?" They have become models of effective use of technology in their classroom. Ms. V, Gr. 7 & 8 Gifted Program

And in this case, the experiences led to enhanced student self-esteem.

10. We've been trying to get teachers comfortable with technology and giving them the staff development to do it in order to do it, so this is just coming from the ground up having the students sort of lead the way as well. We now have two students, a seventh grade girl and an eighth grader boy. Teachers call them out of class and say my printer

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won't work, can you help me do that? It has had a huge impact on my students as far as self-esteem as well. Ms. V, Gr. 7 & 8 Gifted Program

In addition, the students have become coaches.

- … last year my students helped build the school Web site … this year I don't have time to maintain that. Two of my students called me during the summer and asked me for a letter of recommendation to take a college course on programming. I approached them at the beginning of the year and I said, "Do you want to be the Web masters? In addition to maintaining the Web site, they coach some teachers as the teachers build their own Web pages. Ms. V Gr. 7-8 gifted

Discussion and Implications

In this study we found change occurring in areas that are similar to those discussed by Fullan (1991): new or revised materials, new teaching approaches, and the alteration of pedagogical beliefs. Aspects of each of these areas are discussed below.

The regularly scheduled AZCOTT meetings provided opportunities for teachers to learn new technologies, design lessons, share ideas, and reflect on their teaching approaches. This support allowed them to integrate technology more often in their classrooms. As a result the participants often noted changes in their approaches to teaching that were less lecture oriented, more project oriented, more collaborative allowing students to work in small groups, and more collegial in that students became experts and worked with other students and teachers. This is consistent with Becker (1994) who found that opportunities for collaboration supported exemplary computer use; and that exemplary computer users tended to allow for more small group work.

The choice of the Unit of Practice (UOP) format had an interesting effect on teachers during the planning process. When teachers setout to integrate technology, it seems as though the technology may become the focus of their efforts. Since the technology is the element of instruction that is likely the most novel for teachers, this is not unexpected. Using the UOP seemed to redirect the teacher's thinking to make the content area objectives (standards) the focus, as it should be. As a result teachers began to ask themselves, "How can I use technology to effectively teach this content?" instead of "How can I fit some technology into what I am doing?"

Teachers created curricular plans (Units of Practice) and implemented them. The workshops were effective in helping the participants prepare their Units of Practice. At the conclusion of each workshop day participants completed evaluations called exit tickets. This comment exemplifies the value of the training:

"Just speaking for myself, I would like to have our Saturdays be longer, perhaps six hours. I would use the extra time to work with my group on our project."

All teachers appreciated the workshops provided by the AZCOTT program because it provided training within a community of teachers who had similar interests. It helped them think about all of the components of a planned learning activity and thus prepared them to implement the integration of technology in their curriculum. This finding is consistent with the literature that suggest that adequate staff development is a key support for change (Becker, 2000).

Across the classrooms, we found positive changes in student engagement. Teachers noted that students were excited about learning. They displayed initiative by going beyond the assignment and by asking to use computers during free-time and after school. We also found general teacher concerns about noise levels in their classrooms or at least the beliefs that others would find the noise levels in their classrooms inappropriate. The noise that accompanies student engagement may be a good problem, but it also was a real issue that continues to be on the minds of the participants. These findings are consistent with those of the earlier study of Apple's Classrooms of Tomorrow (Sandholtz, Ringstaff, & Dwyer, 1996).

It was apparent that these teachers were excited about what they were doing in their classrooms and convinced that it promoted students' learning. As a result they took what they had learned and shared it with their colleagues. They taught after school technology classes and often assisted their peers to solve technology-related problems. This was primarily evident at the school level, but it also occurred at the district level. For example, at a district technology staff development event, the superintendent of a school district with an AZCOTT classroom remarked "What a difference Ms. T's room has made to the district" and said they would find teacher substitutes for those wishing to visit and participate in that classroom. In another district, one teacher was selected to become a district technology integration specialist as well as continue teaching a section of her grade 7-8 gifted class.

The teachers recognized that adequate access to technology located in the classroom was an important contributor to their success. Having computers in the classroom, as opposed to a computer lab, allowed teachers to use the computers as tools for learning in a natural/organic manner, a process that may seem artificial if confined to scheduled lab times for computer use. For example the teachers said:

I was really surprised at the impact of having the technology in my classroom and the difference that made. We have a 33 station networked computer lab, so [we always had] access to computers. But the problem was I only got to go down there occasionally. Once a week I had my set time, but if anything happened that week, I lost that set time, I was stuck and could not use technology for that week. And that would happen quite a bit. Ms. Lo, Gr. 6

The computers and software need to become something that is open and available. People aren't going to use it if it's too restrictive. If it's in a locked cabinet they aren't going to come to check it out. We need to say, here it is. Come get it. (Mr. B, Gr. 2)

These findings are also consistent with the findings of Becker, 2000, who concluded that access to 5-7 computers in the classroom was a contributing factor to those teachers who regularly had students use technology in their curriculum.

Initially, it appears that technology has become an integral part of each classroom rather than a time set aside to go to the computer lab 40 minutes a week. We think this early success is due to the project's ability to address multiple interventions. Hall and Hord (2001) point out that change often is not centered on one innovation but many. In this case AZCOTT teachers had the support of their principals, participated in over 100 hours of high quality workshop training distributed over the course of a year, attended two local educational technology conferences, received technical support from their school districts, benefited from online support through interactions with their peers and PT3 project staff, enjoyed technical and curricular support from the project manager and her site visits, and received adequate access to technology and the Internet. Although we noted signs of early success, experts on the change process have found that the implementation of change often requires 3-5 years (Fullan, 1991; Hall & Hord, 2001). We plan to revisit these classrooms after the second and third years of the project and trace the developments of the teachers and the preservice students influenced by the AZCOTT classroom examples.

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NECC 2001 Presenter Handouts: Post Conference

last modified; 8/30/01

Name	Size Kind		Last Modified
-fileupload.html	5K	PageSpinner document	08/07/01, 01:33 PM
fileupload.html	5K	PageSpinner document	08/07/01, 01:51 PM
foster_bridget.pdf	1.8MB	document	09/10/01, 11:35 AM
grack_amy.pdf	9K	document	10/03/01, 07:40 AM
grack_amy_ppt.pdf	360K	document	10/03/01, 10:32 AM
hirsch_jim.pdf	27.3MB	document	08/30/01, 01:55 PM
lemoine_eric.pdf	250K	document	08/29/01, 01:49 PM
luke.shelly.brief.pdf	493K	document	09/05/01, 04:20 PM
luke.shellylemongro...	532K	document	09/15/01, 01:47 PM
luke.shellyppt.pdf	160K	document	09/05/01, 02:41 PM
luke.shellyunioncas...	391K	document	09/25/01, 11:42 AM
luke.shellywhitepap...	380K	document	09/25/01, 11:44 AM
munroe_victoria.pdf	866K	document	09/24/01, 06:37 PM
reese_george.pdf	180K	document	08/30/01, 01:24 PM

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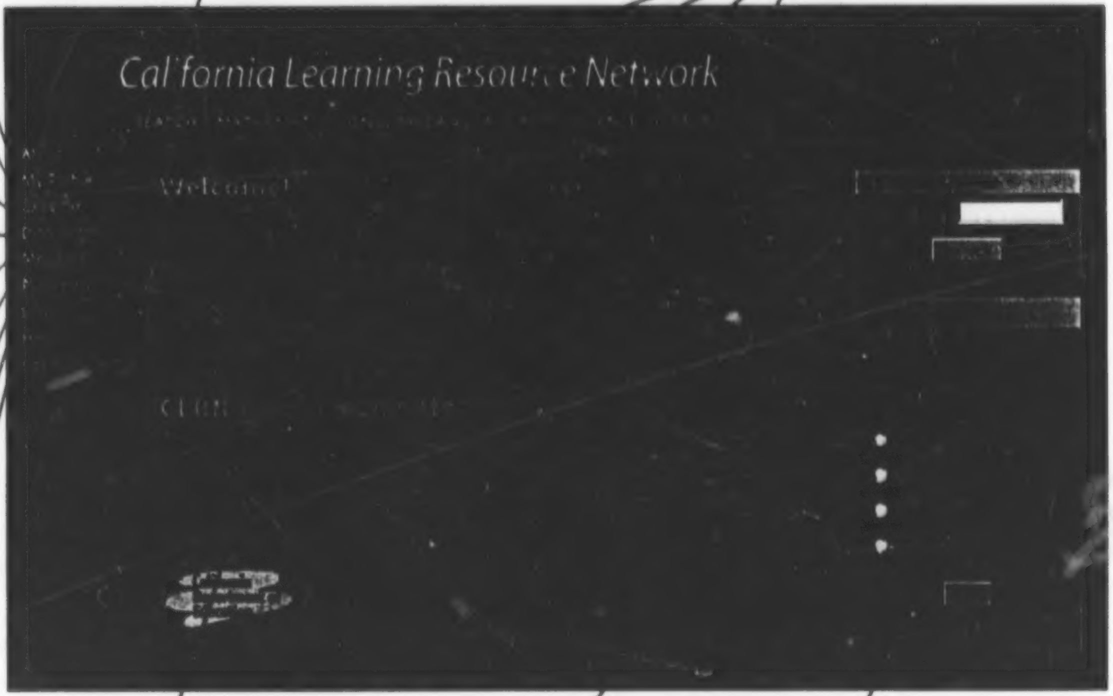

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Dakota Science Center

Digital Cameras Take a Hike – NECC 2001

Colors & Shapes of Nature

National Science Standards:
- **Form and function**
- **Characteristics of organisms (K-4)**
- **Abilities to distinguish between natural objects and objects made by humans (K-4)**
- **Diversity and adaptations of organisms (5 – 8)**

Age Level:
K – 8

Duration:
45 - 60 minutes

Materials:
- **Paint chip cards**
- **Shape cards (draw shapes and patterns on index cards)**
- **Stakes (skewers, popsicle sticks, or dowels)**

THEME:
Recognizing nature's palate of colors and shapes opens our eyes to the biological diversity found in the natural world.

LEARNING OBJECTIVES:
- Compare and contrast the diversity of colors and shapes in different ecosystems
- Understand the role of color in animal and plant survival
- Describe the various ways color is important in nature

BACKGROUND INFORMATION:
- Everything in nature has a color. Searching for colors and shapes in nature opens our eyes to plant and animal life we may not have noticed before.
- This is a great introductory activity to the study of an ecosystem because it gets students looking at all levels of the ecosystem for living and nonliving things. It also introduces students to the role colors play in organisms daily life (i.e. providing camouflage, attracting mates, warning off predators).

ENGAGING QUESTION:
How many different colors and shapes can you find in nature?

PROCEDURE:
1. Before class, glue or tape each paint chip and shape card to a stake. Decide how many groups you are going to break your class into. Each group should have the same set of colors and shapes.
2. Break children into groups. Give each group a set of color and shape cards (each group should have the same colors and

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- **Glue or tape**
- **Digital Cameras (disposable cameras if digital cameras are not available)**

shapes) and a camera.

3. Take the students to a natural area. If possible, have each group explore a separate ecosystem or different area of the same ecosystem.
4. Encourage students to find colors and shapes in nature that match as close as possible to their cards. Remind students that they need to find natural objects, not manmade objects. You may have to discuss the difference between the two with younger students.
5. When students find a color or shape have them take a photograph of the color/shape card by the object that is that color/shape.
6. When the students are done, have each group give a tour of their ecosystem using the color and shape cards as a guide. They should show the rest of the class what they found and explain why they think each thing is the shape or color it is. Compare and contrast the colors found in each ecosystem. After touring all of the ecosystems, ask the students the following questions…
    - What colors/shapes were the easiest to find? the hardest?
    - Is there a color/shape you couldn't find at all?
    - Why are the colors important for the plants and animals?
    - What would the world be like without color?
7. Use one of the assessment ideas below to complete the lesson.

INDOOR ADAPTATION:

If you are unable to get outdoors to do this activity, create the ecosystems inside.

- Before class choose a few different ecosystems from your area that you want to recreate. Find images of plants and animals from these ecosystems or go out and photograph them yourself.
- During class, choose three students to begin the activity. The rest of the students will become the ecosystems. Give students the images from the different ecosystems. Have

them stand with the members of their ecosystem in different parts of the room. The three students are each given a camera and a color or shape card. They go through the ecosystems and look for a match to their color or shape. Once they find one on the images, they take a picture of it as described in the procedure above. After they have taken a picture they trade with the student that was holding the image. The new student then chooses a color or shape card and does the same thing. Do this until everyone has had a turn. At the end of the activity discuss the questions in the procedure above.

TECHNOLOGY LINKS:

Visit these web sites to learn more about the role of color in animal survival:

- http://members.aol.com/Art1234567/Camo.html
- http://howstuffworks.lycos.com/animal-camouflage.htm
- http://www.comptons.com/encyclopedia/ARTICLES/0125/01488384_A.html
- http://school.discovery.com/homeworkhelp/worldbook/atozscience/p/448400.html

ASSESSMENT IDEAS:

- Have students draw or paint the ecosystem they investigated, paying attention to color and shapes.
- Have students create an online media show of their colors and shapes images using the iMatrix software http://imatrix.natureshift.org.

EXTENSIONS:

- Extend activity to include textures and sounds in the ecosystems.
- For older students, go into detail of why animals and plants are certain colors. Have them do research about the importance of color in nature (i.e. camouflage, warning coloration, attracting mates) and create a multimedia presentation using their

images and information they found.

- Indoor extension: When you hand out the images from the different ecosystems, don't tell students what ecosystem the plant or animal belongs to. Instead have the students figure out where they fit in.

SOURCE:

Amy Grack, Education Developer grack@dakota-science.org

View this lesson plan and presentation online on our Educators Page (click on "Presentations").
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After September 1:
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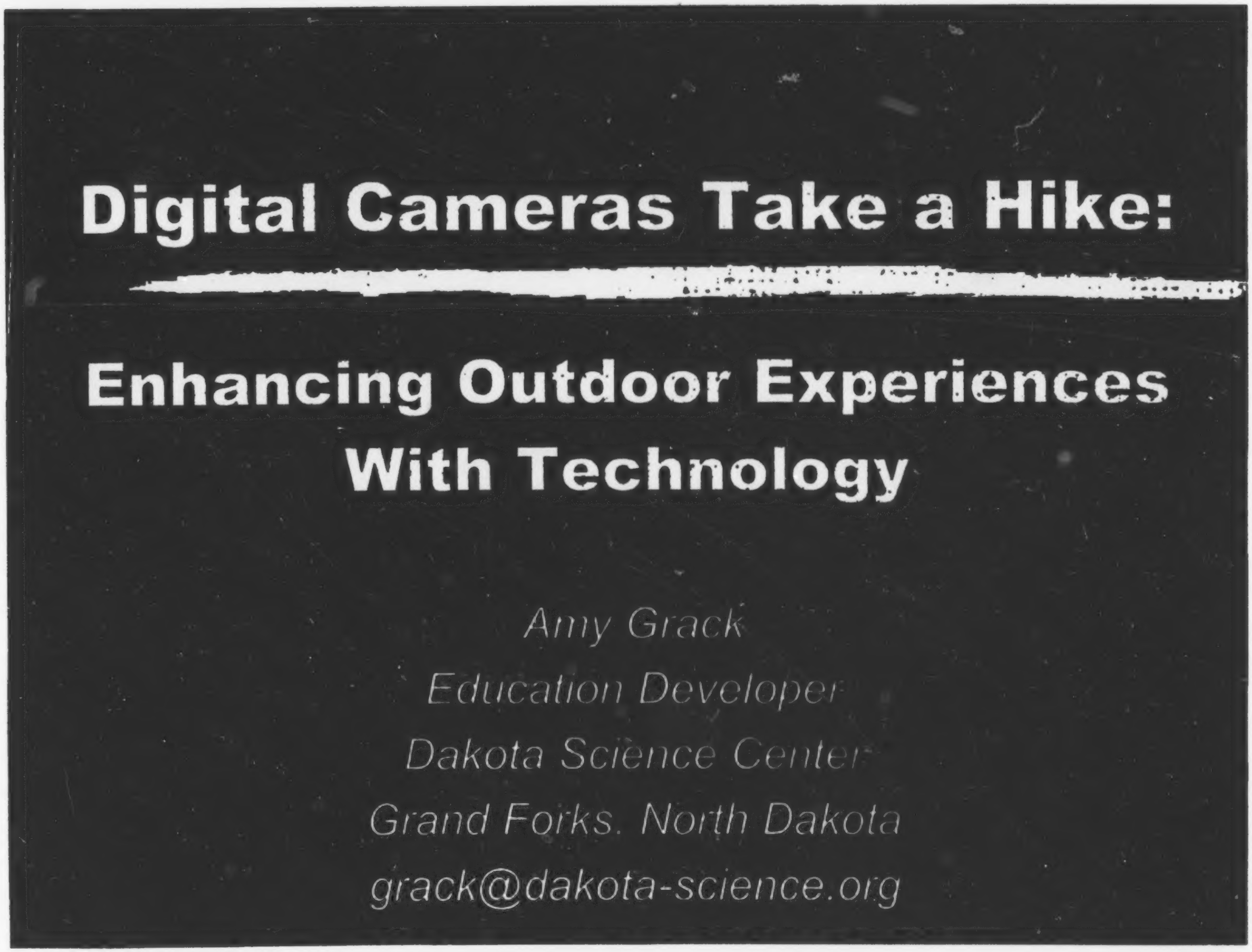

Digital Cameras Take a Hike:

Enhancing Outdoor Experiences With Technology

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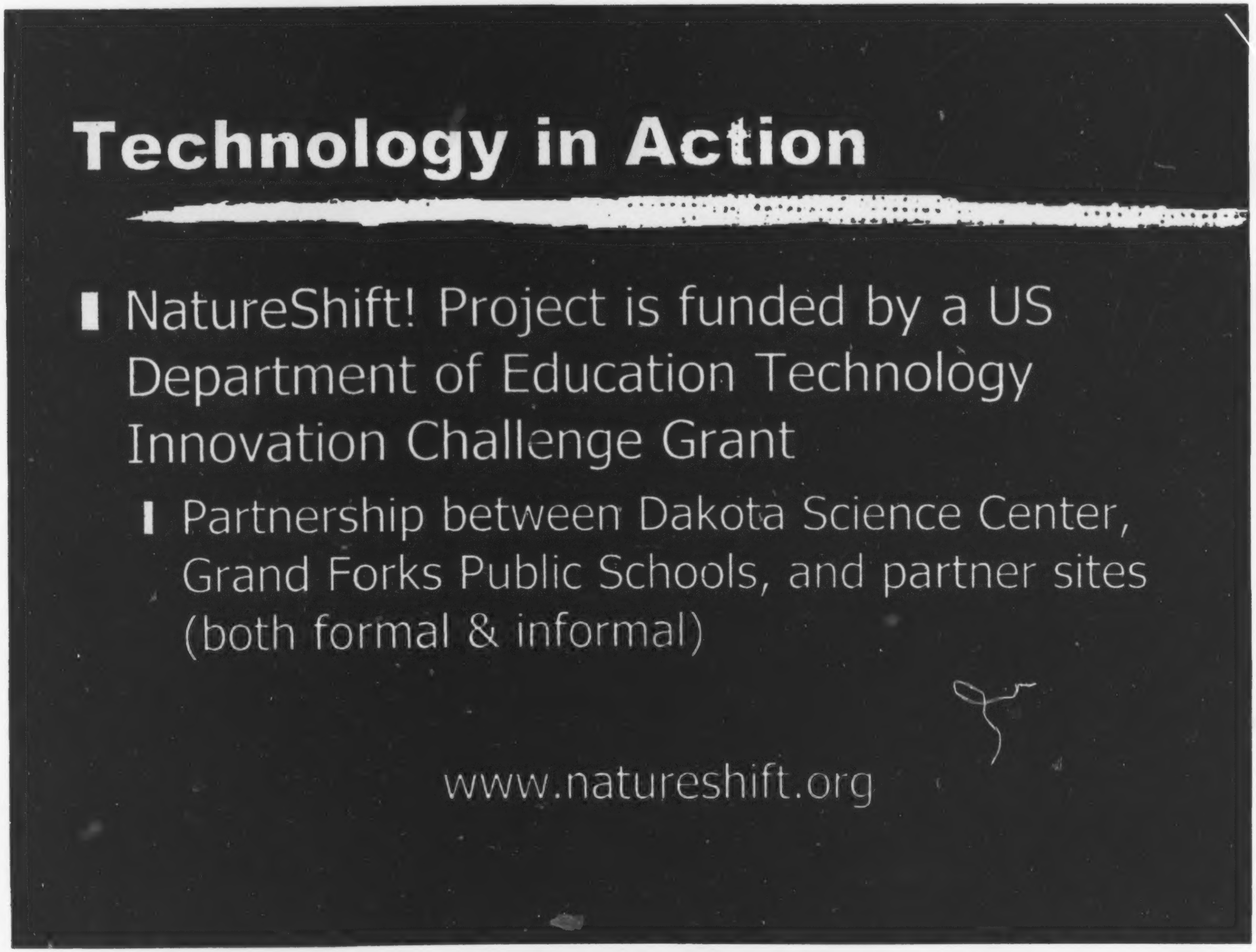

Technology in Action

- NatureShift! Project is funded by a US Department of Education Technology Innovation Challenge Grant
  - Partnership between Dakota Science Center, Grand Forks Public Schools, and partner sites (both formal & informal)

www.natureshift.org

Overview

- Real World Experiences
- Technology in the Outdoors
- Digital Cameras As a Tool
- Digital Cameras Take a Hike - Activity & Examples
- Creating Online Media Shows
- Share Your Experiences
- Now You Try It!

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Real World Experiences

- Essential in education
- Many students lack a connection to the natural world
- Competing with virtual experiences
- How can technology be a part of real world experiences?

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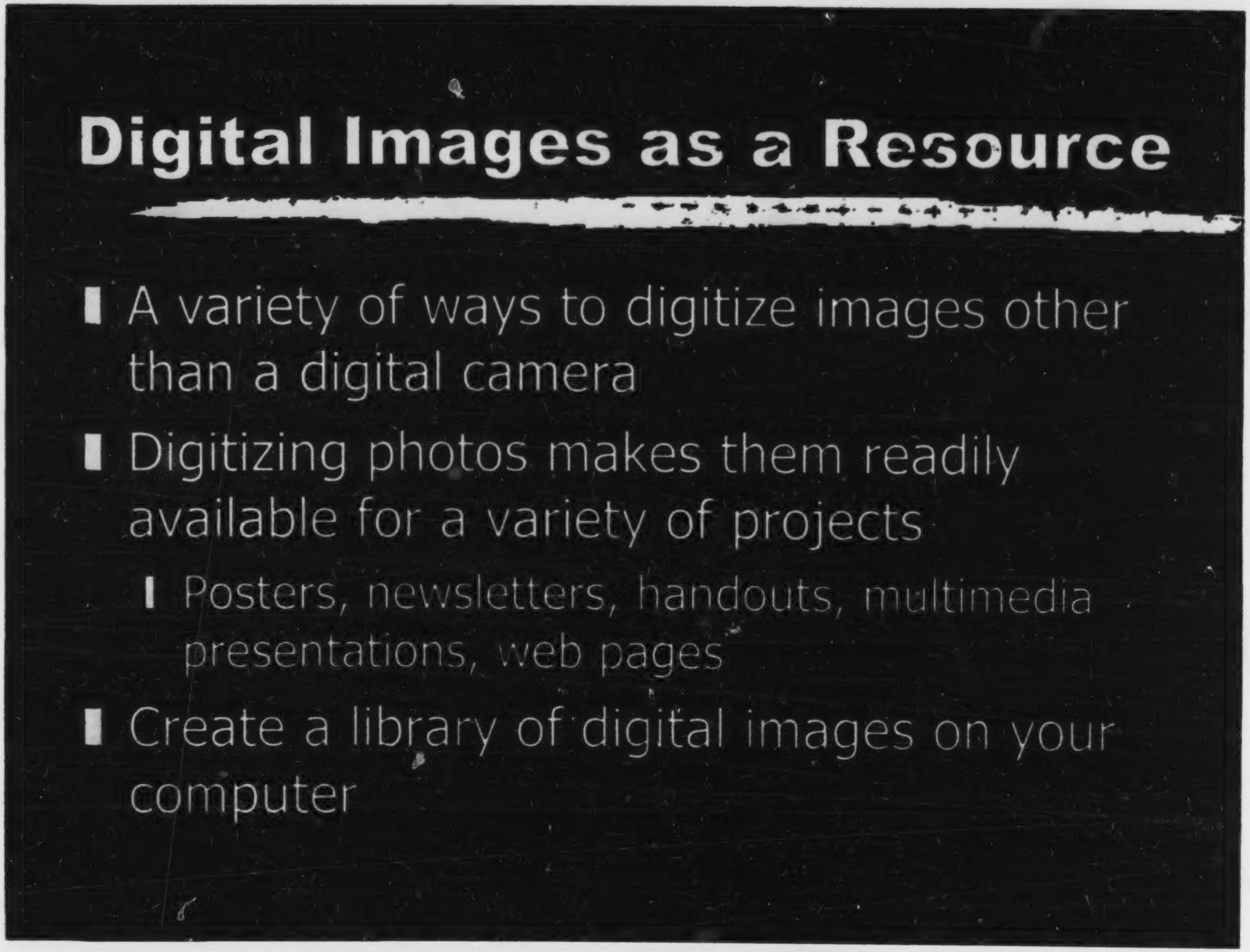
Digital Cameras Outdoors

Technology should be seen as a tool to enhance an experience, not replace it

Digital Camera

- Similar to film cameras & easy to use
- Photographs saved on removable media - memory stick, floppy disk, CD
- Some can record short movies & still shots with sound
- Teachers can keep the images while sending copies home with students on floppy disks or CDs



Digital Images as a Resource

- A variety of ways to digitize images other than a digital camera
- Digitizing photos makes them readily available for a variety of projects
  - Posters, newsletters, handouts, multimedia presentations, web pages
- Create a library of digital images on your computer

Digital Cameras Take a Hike

Now that you know about the technology, it is time to see it in action!

Snow Stories

- Capture animal signs with the digital camera
- Example project from 1999 using an analog camcorder
    - Online Snow Stories Exploration http://natureshift.org/rangerR/natwond/natwond.html
    - Summative Project - Tracks Tribune

Colors & Shapes Activity

Colors & Shapes of Nature

- Integrates multiple areas of study
  - Can be used to teach technology, art, and science
  - The science & art connection
    - "Nature's Palate" North Dakota Museum of Art Camp http://natureshift.org/partners/TRSP/kids.htm#Art%20Camp

Online Projects

- What is iMatrix?
  - FREE online software
  - http://imatrix.natureshift.org
- Take a digital hike, then create a media show!
  - Example media show project
    - Turtle River State Park [illegible] http://imatrix.natureshift.org/search_media_shows.asp?msid=188
  - Can also create local field guides and life lists!

Ranger Rosie

- Visit Ranger Rosie for lots of Environmental Education activities and ideas that use technology!

www.natureshift.org

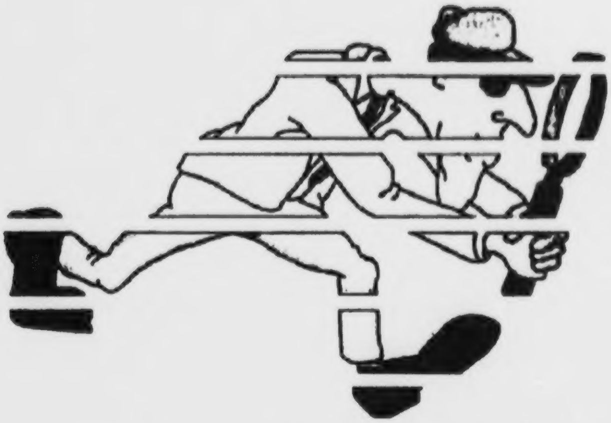
Final Thought

Take Only Pictures,

Leave Only Footprints

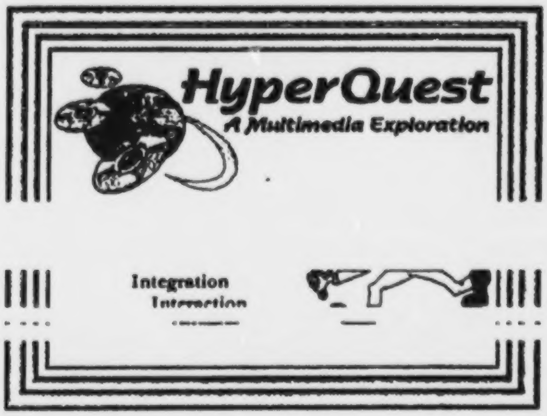
HyperQuests

Interactive
Student-Centered
Multimedia/Internet
Investigations and Activities



This idea looks good enough to investigate!

HyperQuests: Interactive, Student-Centered Activities



The phrase "HyperQuest" is meant to have you imagine a process where students are engaged in multimedia-based learning and presentations as part of classroom-based explorations with multiple information sources from multiple media types. The process of a HyperQuest is most closely associated with student activities that center around four "I" concepts: inquiry, investigation, integration and interaction. The design of HyperQuests also includes the "I" resource that is becoming the focus of many classrooms; the Internet. A HyperQuest provides a framework within which a student operates in an independent learning mode, yet is guided by teacher or student templates to use resources that provide appropriate content to the unit of study. These resources will include diverse options such as the Internet, CD-ROMs, laserdiscs, audio, motion video, animation, text, and digital cameras. The process of synthesizing, evaluating and presenting the individual findings, based upon those resources, is left to the student.

The creation of a HyperQuest centers around the use of HyperStudio as an authoring tool. The teacher (or student) creating the HyperQuest should have a comfortable understanding of how HyperStudio handles multiple forms of media and peripherals. The purpose of a HyperQuest can be multi-faceted. Primarily it serves as a means to conserve student time by focusing their effort to resources that have proven content to support the unit of study. This is not to say that the purpose is to restrict the student's inquiry to a limited number of resources, but rather to give guided practice in using multiple types of resources and perhaps allow any time saved to be used in free-form research areas. HyperQuests can be designed to have students work with particular types of resources to demonstrate their value or practice their use. They can focus on a single content area or be designed around integrated concepts. In addition, an effective but simple HyperQuest could revolve around the student use of only guided Internet resources using the techniques discussed in this session. Visit (k-12.pisd.edu/HyperStudio/HyperQuest.html) for more information on the concepts of HyperQuests. ***Please see page 18 for a discussion on the necessary elements and techniques in a classroom environment where the concepts of HyperQuests will flourish best.***

A HyperQuest should contain these elements at a minimum:

1. Introductory material to set the stage for the concept and environments that the student will be experiencing.
2. Well defined task(s) that the student is expected to complete.
3. Help screen(s) that describe what navigation buttons and tools are available to use throughout the HyperQuest.
4. Resources that the student can use to accomplish the stated task. These might include text to be read as part of the HyperStudio stack itself, references to print material that the student is encouraged to read, buttons that connect to laserdisc sequences for the student to view, buttons that connect to CD-ROM resources, animations, motion video, buttons that send email to identified experts or project mentors and links to Internet resources that support the unit of study.
5. Template cards that the student will use to complete a portion of their task. The activities requested of the student to complete might include researching multiple Internet sites and creating links in HyperStudio to those sites which best support the student's presentation, adding images taken with a digital camera or video camera, creating animations to visualize processes, audio recordings to further explain particular thoughts, text as necessary to finalize the communication of ideas and graphic images to accurately depict the findings. These template cards give a structure to the result of the HyperQuest investigation.
6. HyperQuests lend themselves to collaborative work. This could be groups of students within a single classroom or students in remote locations using the Internet to make connections with each other.
7. Self-evaluation opportunities throughout the course of the HyperQuest to enable students to produce a high quality product.
8. The completed project given as a presentation for the class or other interested groups. This communication of the findings is an important concept that should be central to the successful completion of a HyperQuest.
9. Open ended topics that lend themselves to further exploration. A first completion of a HyperQuest may lead to further investigation by other students building off of the earlier result.

As you begin the process of designing your own HyperQuests, keep these thoughts in mind:

☑ Identify those areas of your curriculum that seem to be the most likely to be supported by freely available Internet resources and other electronic-based information.

☑ Keep bookmark lists or create HyperStudio stacks with sections devoted to topics in the areas you're most interested in designing a HyperQuest for students.

Notes

☑ Involve other colleagues in the collection and evaluation of HyperQuests that have already been produced.
☑ Research the topics yourself before assigning HyperQuests to students to make certain that an appropriate number of resources exist. Of course, expect the students to find resources that you didn't since that is the nature and size of the Internet!
☑ Much as you expect of students, work collaboratively with colleagues as you develop your original HyperQuests that integrate Internet resources. This can be done locally or remotely via email.
☑ Give back to the Internet what you've had the opportunity to experience and use - in other words, share your HyperQuests so that others can benefit from your work.

Classrooms have undergone many changes over the past few years. Based on research, many schools are learning the importance of creating a brain-compatible environment. There have been various attempts to accomplish this task by the integration of disciplines in the curriculum. Key elements of a brain-compatible classroom should include:

- student choices
- multiple activities
- an enriched environment
- meaningful content that integrates various technologies

In this unique classroom the teacher becomes a facilitator and the students become self-directed learners. In support of the brain-compatible classroom, the federal government's SCANS report stated: (www.ncrel.org/sdrs/areas/issues/methods/assment/as7scans.htm)

"The old ways of lecturing and memorization must give way to the method of learning by doing. We need to mesh what we teach with what the real world is doing. Information should be put in context so it is more relevant and interesting."

In answer to this paradigm shift, the HyperQuest activities center around the four "I" concepts: inquiry, investigation, integration, and interaction. HyperQuests can be used to:

- introduce new concepts
- introduce new technologies
- enrich already developed curriculum
- provide a performance-based assessment for the teacher to share with parents

Using HyperQuests in the classroom gives the teacher an excellent opportunity for multitasking when classroom technology is limited. HyperQuests also support the profiles indicating technology-literate students as indicated in the NETS Project (http://cnets.iste.org/sfors.htm).

Designing a HyperQuest Activity

The overall structure of most HyperQuests is similar in design. Background information on the topic under investigation, guidance and access to useful resources and direction on activities to complete are all included on cards in what can be called the **Task Stack**. Corresponding cards where students place the information they discover or create can be called the **Project Stack**. The teacher's responsibility is to first preview and identify those resources that the students will be guided to use as part of their investigation. Next, the teacher needs to create the task stack which all students use to guide their activities along with the template project stack that contains cards for the students to use in creating their project. Our primary goal in creating these HyperQuests is not to assess students on their use of HyperStudio tools, but rather to assess how they gather, evaluate and synthesize the information the task stack guides them to. In some quests, students are given sequential guidance to complete their project stack. Each instruction/task card for the students would have Background Information and the Task *(Figure 1)*. Students would read and determine what they will create on their Project Card. Students use the Project Card Button to take them to their project stack to record their findings. Each instruction and student project card have corresponding numbers in the bottom right-hand corner. When finished with a project card, students click on the Task Button to return to their instruction card. Before attempting another task, students should proofread the instructions to be sure they have completed their card correctly. Students continue on with their research project by clicking on an icon to take them to the next instruction card in a sequential manner. Typically this type of HyperQuest would have students complete all of the tasks included.

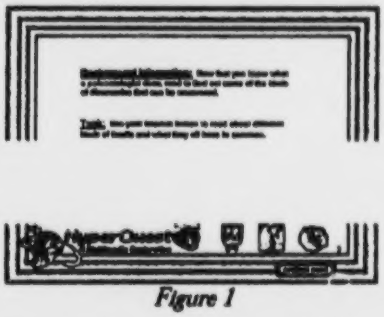


Figure 1

A second form of a HyperQuest would use a more interactive design where a "menu" or "navigation" card would allow student choice in the selection of tasks. This design would allow teachers to modify the number of tasks required based on student ability but it would also eliminate a HyperQuest design where each task builds on information discovered in a previous task. The steps listed beginning on the next page give a complete "roadmap" of the steps necessary in creating the Task Stack portion of a HyperQuest where a wide variety of resources have been identified for student use. Keep in mind that HyperQuests could be designed with only a single resource (such as the Internet) being used by students.

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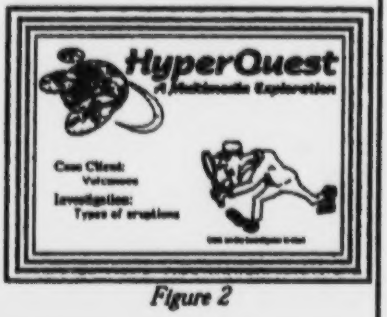
Here is an example of the steps you might use if you were to create a HyperQuest that has students investigating information on volcanoes and the four ways they erupt. The first step is to create the "task" cards for students.

1. Create individual cards to display information or links to information that you want your students to explore in their pursuit of the investigation topic. These cards should contain only one type of resource (text, laserdisc sequences, Internet connections, etc.) per card to help students organize their information. This activity will take the teacher a significant amount of time to review and gather the resources that the students are expected to use.

For this sample HyperQuest, the cards might be designed as follows:

Card 1: Create a title card that gives the topic of the HyperQuest (*Figure 2*).



Case Client: Volcanoes
Investigation: Types of eruptions

Figure 2

Card 2: Create a navigation card showing buttons and tools that are available for the student to use throughout the HyperQuest (*Figure 3*). There could be instances where you can combine the design of the introductory material and the navigation buttons into one card, particularly if you only include a few tasks in the "quest".

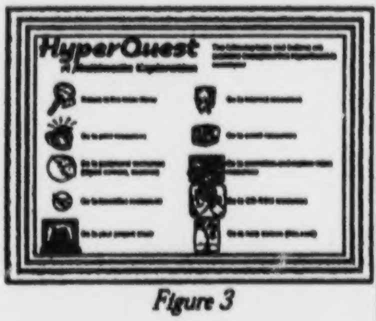


Figure 3

Card 3: Present introductory material on volcanoes for the students to use as background information before they begin their HyperQuest. This sample screen includes icons for student choice on the various tasks included in this investigation (*Figure 4*).

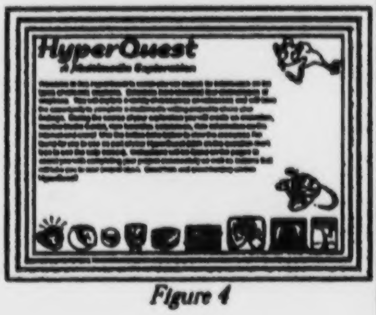


Figure 4

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Card 4: Have students locate the article titled "Mountains of Fire" in the March, 1998 issue of National Geographic World and read for information on types of eruptions and the "Ring of Fire" (Figure 5). Notice in the design of this card how we've included "snapshots" of the print material students are asked to read to act as visual cues. The icons included on the card allow the students to choose to return to the menu card or move to their corresponding project card.

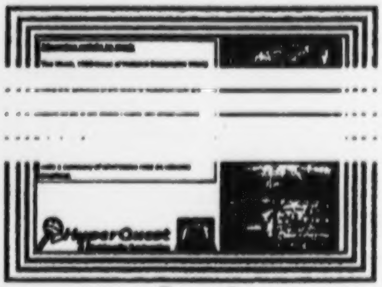

Figure 5

Card 5: In this sample HyperQuest, students do not have much of an opportunity to use a digital camera to capture images, but a scanner can be used to bring any original drawings into the project (Figure 6). Notice the consistent navigation icons.

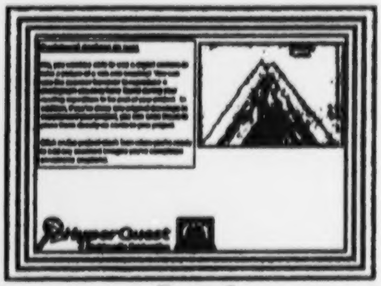

Figure 6

Card 6: Students will view four laserdisc sequences on volcano eruptions and will need to describe the various types in their project (Figure 7). In addition, students are asked to create two buttons showing laserdisc sequences in their completed project. ***Instructions on how to control laserdisc players via HyperStudio are included on page 16, in the Tips and Hints section.***

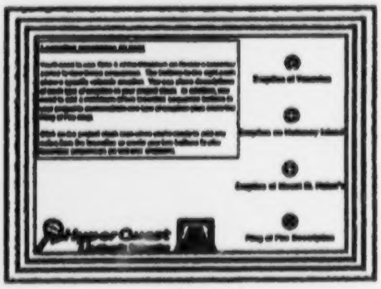

Figure 7

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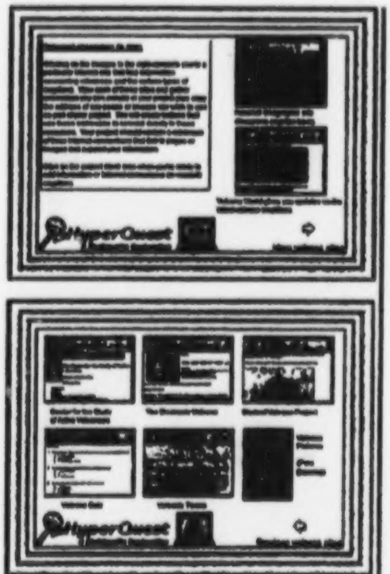

Figure 8

Card 7: Internet sites (pages, images, audio, and multimedia objects) are major resources that can be used in HyperQuests. In this sample, students will travel to "guided" sites to search for information related to the topic of volcanic eruptions (*Figure 8*). The expectation is that the students will not find the necessary background material on the initial page of the site, but will have to follow links to be successful. Students will have the option of writing a narrative or summation of the information found, but are required to create a minimum of three buttons that link to Internet pages or images containing information supportive of their project.

These cards illustrate how a teacher can use HyperStudio to guide students to only those Internet sites that have been previewed to guarantee authentic and relevant information. Keep in mind that our goal is not to have students learn to search the Internet or evaluate the contents of Web pages with these HyperQuests, but rather to guide the students to appropriate resources and assess them on their ability to evaluate and synthesize those known information sources. With the Internet (World Wide Web) now having grown to over 2.1 billion pages, 83% of which are commercial in content and only 6% informational and educational in nature, it's critical to guide the students so that their limited online time is used as efficiently as possible. ***Information on how to connect to Internet sites via HyperStudio and the NetPage NBA are included on page 16, in the Tips and Hints section.***

Card 8: The use of email to pose questions to identified experts or to correspond with a mentor can be facilitated through a card designed to automate those connections (*Figure 9*). Through the use of the NetPage NBA, a button can be created that directs mail to the appropriate person(s) you've identified as resources for your students.

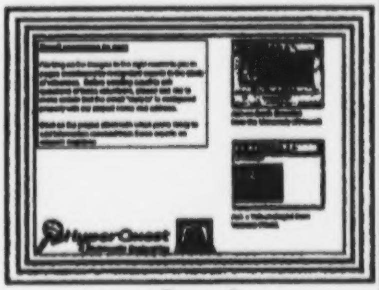

Figure 9

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Card 9: Many HyperQuests will lend themselves to the creation of animations on the students' part or the use of motion video to explain a topic more thoroughly. As sampled on this card, the students are required to create an animation that simulates one of the four eruption types (Figure 10) on their own project card.

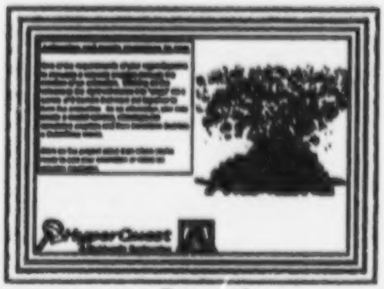

Figure 10

Card 10: There probably are a variety of CD-ROM disks available to support many of your HyperQuests. This card shows a sample of having connections in HyperStudio start a CD-ROM encyclopedia and requires the students to search for volcano information and view the images included to look for volcanic eruptions (Figure 11). ***Information on how to have HyperStudio control CDs and launch other software programs are included on page 15, in the Tips and Hints section.***

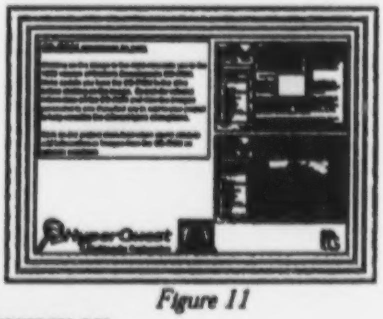

Figure 11

Designing your own HyperQuest is your opportunity to use HyperStudio to help guide your students in their investigations of a wide variety of units of study and also enables you to guide their use of various technology components in support of those activities.

2. Once the task (or resource) portion of the HyperQuest is completed in a fashion similar to what was described above, a student template project stack for the multimedia writing needs to be designed. Remember that our goal is not to assess students on their HyperStudio skills, but rather to ensure them success in their investigation of the topic of the HyperQuest. The cards contained in the project stack should follow relatively closely to the resources given in the HyperQuest, although students have the freedom to add cards as needed to complete their project. The buttons on the HyperQuest that show a link to the "project stack" will take students to the corresponding cards here. It's also important to place buttons on the project stack that return the students to the HyperQuest for continued use of the resources.

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The student project stack might be organized like this for the HyperQuest described above:

Card 1: Create a title card for the multimedia writing project stack. Students can be encouraged to individualize this card as an introduction to their project and perhaps use a digital camera to place their picture on it (Figure 12).

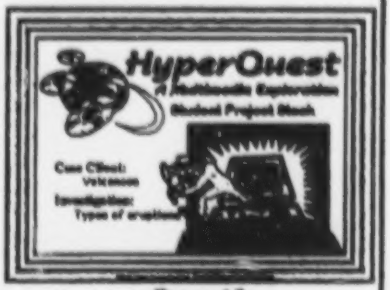

Figure 12

Card 2: This card can serve as a menu to the rest of the template cards (Figure 13). The template cards will follow the same format as the HyperQuest "task" stack. The buttons from the HyperQuest "task" stack take the student to this "project" stack and all of the template cards in this stack need to have a button to take the student back to the HyperQuest "task" stack.

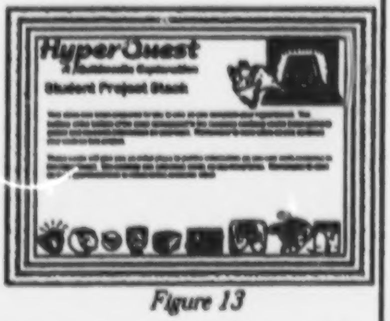

Figure 13

An alternative to this "menu card" design of the student project stack would be to make the cards linear, that is, each task/project card combination needs to be completed before moving to the next task. This process would allow students to experience how one piece of information can lead to additional discoveries.

Card 3 (and subsequent cards): This sample shows how the individual student cards can be arranged to allow them to add their information as they obtain it to their multimedia writing project stack (Figure 14). Your design should include a project card for each resource type presented in the HyperQuest task stack. The students can add more cards as the need arises. You can add text boxes and instructions to the cards as necessary to help ensure student success as they work more independently. Subsequent template cards in the student project stack would be created in a similar fashion.

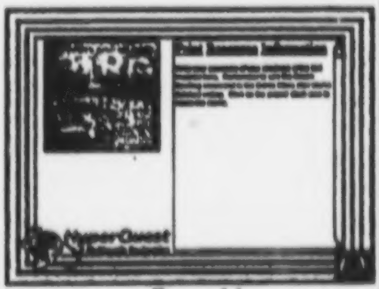

Figure 14

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3. The time needed for students to complete their HyperQuest depends on the number of resources you've provided students to use in the HyperQuest and the quality of work you wish to receive. Evaluation is a critical component of the overall HyperQuest experience, so have your expectations set and communicated to the students before they start the project.

This gives a fairly complete example of a HyperQuest that makes use of a significant number of resources. Certainly a HyperQuest can evolve over time and I encourage you to begin with a version that perhaps uses only one or two resource types to see what success your students have with the process. Although this takes quite a bit of setup work by the teacher at the beginning, the quality of work that the students can produce in an efficient manner will make the task seem very gratifying. Sample HyperQuests are available for you to download on the HyperQuest Internet site (k-12.pisd.edu/HyperStudio/HyperQuest.html).

Please be willing to share any HyperQuests you complete. Your experience will undoubtedly be valuable for the next person who attempts this process. Fully designed HyperQuests are available from the HyperStudio Network (www.hsnetwork.com).

Assessments for HyperQuests

As educators we know assessment is an essential component of any classroom environment. We also know there is a need for a variety of assessments to better understand how students are progressing. Many educators are placing performance assessment at the top of their list to best evaluate students' understanding of specific concepts. Even though there is a need for standardized testing and traditional assessments such as: multiple choice, fill in the blank, and short answer, performance assessments give us more complete evidence as to what students have actually learned. Completing a HyperQuest is one way to assess students' ability to apply what they have learned to create a product. Assessing the HyperQuest itself requires new thought and new rubrics designed for multimedia writing.

The fact that a HyperQuest requires students to create work of their own by being responsive to the resources made available to each particular task is an excellent model of performance assessment design. As HyperQuests are utilized, teachers are able to observe actual student performance and evaluate performance on previously established criteria. When HyperQuests are used in the classroom, students are assessed on both the process and the end results of their work. Many times a HyperQuest will include real-life tasks, which require students to use higher-order thinking skills to complete their quests. Students completing a HyperQuest are assessed on their accomplishment of completing a content rich HyperStudio stack. It is our job to help students see the importance of completing tasks to the best of their ability. HyperQuests enable students to improve their performance by completing tasks that are designed to encourage quality products.

If HyperQuests are going to be used as one type of performance assessment, teachers must have assessment tools that encourage student success. Rubrics, checklists, and self-assessments are valuable tools to help the teacher/student evaluate performance. Rubrics and checklists should be given to students as the task is assigned so they know exactly what is expected. As teachers create rubrics they may choose to include students in the process. Even though there are a variety of generic rubrics available to educators, there is a need for teachers to create their own. When creating a rubric, keep in mind it is not a grading system but a way to set expectations for high quality work. Rubrics should be designed with the following elements incorporated:

- Levels of excellence
- Specific criteria
- Specific indicators that describes what the various levels of excellence look like for each criteria

When creating levels of excellence always include an even number of levels. This forces a judgement and does not allow for a "middle of the scale" decision. Words or numbers can represent levels. Select specific criteria that focus on quality of the performance the students have demonstrated by completing the HyperQuest. When deciding on indicators, be sure they are descriptive but not judgmental. Indicators should give a clear picture as to what the level looks like in the finished product. Shown below is a sample of a rubric that could be used to evaluate a HyperQuest. Keep in mind however, specific criteria will change according to the types of tasks the students are asked to complete in their quest.

Content Accuracy	No relevant content	Some content was reported accurately	Most findings reported accurately	All findings reported accurately
Task Directions	Did not complete any task as directed	Completed some tasks correctly	Completed all tasks correctly	Completed all tasks correctly and elaborated on most
Quality	sentences with little or no punctuation, no creativity displayed when adding art work or graphics	sentences with some punctuation mistakes, some creativity displayed when adding art work or graphics	sentences complete with few punctuation mistakes, creativity displayed on most added art work or graphics	sentences with proper punctuation, creativity displayed on all added artwork or graphics

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Student Evaluation Checklist for HyperQuests

HyperQuest Investigation ______________________________

Evaluator's Name ______________________________

Project areas to check:

Completeness

1. All assigned task cards completed on corresponding project cards ____
2. All work proofed for grammar, spelling and multimedia content ____
3. Used required resources on each project card ____
4. Completed project stack operates as an independent presentation ____

Classroom Work

1. If a collaborative project, have all members had an opportunity to experience all the technologies used? ____
2. Have all students been given adequate preparation in the technologies they're expected to use? ____
3. Have students attempted to determine the authenticity and validity of all sources used? ____
4. Are all sources cited properly and credit given where due? ____

Design

1. Project stack contains basic parts: title screen, menu or navigation card, original writing and art as required ____
2. Pleasant contrast between text, buttons, and backgrounds ____
3. Text used is easy to read (consider fonts, sizes, colors and styles ____
4. Navigation buttons all operate correctly ____

Creativity

1. Original artwork has been used as well as other art in creative ways to illustrate the project ____
2. Writing samples are interesting and contain information related to the defined task ____
3. Included art, sound, video and other multimedia elements are consistent with the project card theme ____
4. Has the appropriate balance of graphics and sound versus text been used? ____

For a comprehensive look at rubrics visit the following site:
(www.interactiveclassroom.com/neg-cont.html)

Notes

HyperQuest Hints and Tips

HyperStudio is a very versatile authoring tool, not only because of its ease of use, but also because of the way it allows you to control devices such as CDs and laserdiscs and even Internet connections and objects. This section is devoted to a variety of hints and tips that will allow your HyperQuests to give even more options to students in their choice of resources to use as investigative tools.

Using data CDs and other applications from HyperStudio

As you prepare your task cards for student use you may want them to access a CD-ROM, such as an encyclopedia from within the HyperQuest or possibly start another program (such as Microsoft Word) to complete an activity. Rather than have students start the CD or other program from the Task Bar or Application Menu, follow these steps to place an action on your card that starts the CD or program without leaving HyperStudio.

The steps....

1. To launch a data CD or other application in your HyperQuest, create a new button or an action on a graphic item. From the Actions dialog box, select Another Program *(Figure 15)*.

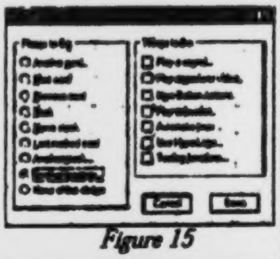

Figure 15

2. From the Launch Options Menu click on either "Choose" button to select the application or document you want to start when the action is initiated *(Figure 16)*. Notice in this example how the application "gme98.exe" has been selected. When this action is selected from the card, the CD-ROM version of Grolier's Multimedia Encyclopedia will start and look for the CD in the local drive. You cannot direct students to an individual article on the CD - this action simply starts the CD menu program, but it does make it easy for students to use this type of resource without using a method outside of the HyperQuest task cards. Any other application you wished to be selected in this manner (such as Microsoft Word) would be built in a similar fashion.

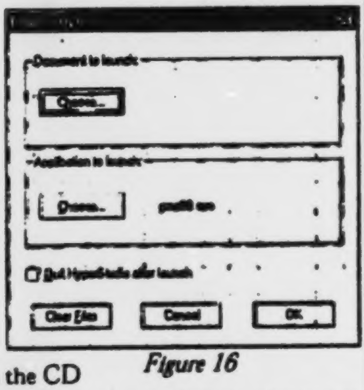

Figure 16

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Controlling laserdisc players from HyperStudio

If you have laserdisc resources that you want students to view as part of a HyperQuest, you can build actions that will send the proper frame number or sequence directly to your laserdisc player from HyperStudio. This will prevent students from using the remote control or bar code reader to browse the laserdisc for clips other than those that you've found to support the unit of study. This does require that your laserdisc player be connected directly to a computer using a CC-04 cable (Macintosh) or CC-13 cable (Windows PC).

The steps....

1. To add a laserdisc sequence to your project, create a button or action on a graphic item. From the Actions dialog box, select Play a movie or video.
2. From the Video/Movie Source dialog box, choose Laserdisc player (*Figure 17*). You'll be presented with a "remote control" where you can control which sequence of frames you want displayed from your laserdisc player each time the button is pressed (*Figure 18*).

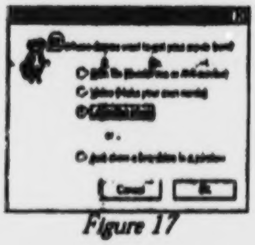
Figure 17

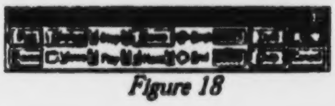
Figure 18

Connecting to Internet resources from HyperStudio

The NetPage NBA provides HyperStudio with a method of connecting to live Internet resources when using buttons or other object actions. Since HyperStudio is not an Internet browser, NetPage simply takes any Internet universal resource locator (URL - commonly called an "address") and passes the address off to either Netscape Navigator or Internet Explorer. The browser then displays the Internet information contained at that address. In some ways, the process is like a "tag team" where HyperStudio and your browser work together.

One of the most valuable applications of the NetPage NBA is to create "guided access" stacks with button connections only to sites that support units of study directly. This not only saves valuable online time by having students and staff go directly to sources that have proven content, but also tends to keep everyone from "browsing" as much which happens when using a search engine to find information.

The NetPage NBA is the connection to Internet resources of all types: pages, images, sounds, movies and even other HyperStudio stacks! Any resource that is usable by an Internet browser is also able to become part of a NetPage link.

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The following steps are necessary to create an Internet connection in HyperStudio:

1. Gather the addresses of the Internet resources you plan to create connections to. These can be copied from the Location box of your browser application and saved to a word processing file for later use.

2. Create a button or object action in HyperStudio.

3. Select New Button Actions from the Actions Menu *(Figure 19)*.

**NOTE: Version 4 of HyperStudio now contains "Go To URL" in the "Things to Do" portion of the Actions dialog box - no NBA is needed.*

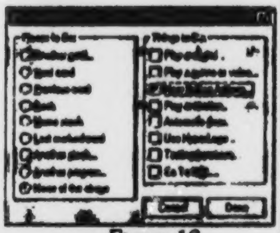
Figure 19

4. Select NetPage from the list of Names presented *(Figure 20)*.

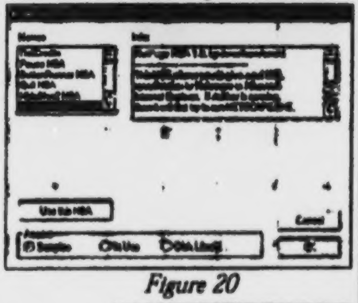
Figure 20

5. Select the Use this NBA button and then paste or type the Internet address (URL) into the Do URL dialog box *(Figure 21)*.

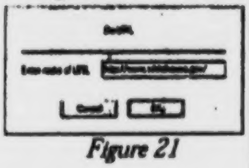
Figure 21

The button or action created will connect to that Internet (or intranet) address via Netscape (or Internet Explorer) each time you press it. The process described above does not need live Internet access if you've gathered the addresses in a word processing file. Live access is needed only when you actually use the buttons to display the Internet resources. It's always a good idea to have your Internet browser started before you try your NetPage buttons. More complete information on these types of connections can be found in the book, HyperStudio and the Internet, available from the HyperStudio Network (www.hsnetwork.com).

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Key Elements in Active, Student-Centered Classrooms

What can be done to help promote student success when using the concepts of HyperQuests? The following nine elements can contribute greatly to teachers and students experiencing a successful learning environment. Each one relates to all the others to produce the best classroom setting possible.

Student-Centered

In a student-centered classroom students learn through discovery and take responsibility for their learning. The teacher is a facilitator of learning while students are actively involved in a non-threatening learning environment. Students feel comfortable asking questions and taking chances while they participate in a curriculum that captivates, motivates, and challenges them.

Relevant Content

Not only should the curriculum be motivating and challenging, it must be age appropriate for the students. Concepts should be introduced as students are developmentally ready to learn them. Be careful not to push too quickly through concepts that may be needed as building blocks for the student's learning at a later time. Concepts should be integrated and taught when it is relevant to the learning task. The content must provide real-world applications for the students and also provide opportunities for them to take their learning to the application level.

Technology

As opportunities arise for adding technology to the classroom, be sure to include a variety of resources. Students must be able to use a variety of technologies and utilize different types of software. Most importantly, the technology must be integrated into the curriculum content. Students should have technology accessible to them when necessary to help them experience a higher level of learning or to assist them in producing quality work. When integrated into the curriculum regularly, technology becomes a tool for students to enhance their learning.

Notes

Multiple Activities

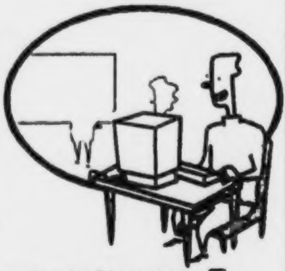
As activities are planned, teachers must keep in mind all of the different learning styles of the students. A variety of activities to meet these different learning styles must be planned. At the same time, these activities must meet all the multiple intelligences as students' strengths lie in different areas. As many of our classrooms consist of a heterogeneous group of students, there must be a combination of both long term and short term activities to meet their needs.

Choices for Learning

In order for students to take responsibility for their learning, they must be given the opportunity to make choices. We must prepare our students for the real world by allowing them to make decisions and solve problems on their own. While in the classroom we can encourage student choice in activities, uses of technologies, ways of participating, and methods of presenting their discoveries. Though these decisions should not always be made by the students, it is necessary for them to be an active participate in their learning. Teachers must give up some of their control to allow individual choices among the students.

Enriched Environment

When visiting a classroom that we would consider to have an enriched environment, you would see students participating in hands-on activities, current class products being displayed, and perhaps students engaged in activities that take them outside the physical classroom. At appropriate times you would see resource people sharing their knowledge about a specific concept relevant to the content being taught. Teachers must continually strive towards having an enriched environment that allows students to reach their maximum level of learning. To have this enriched environment, a teacher must not teach from printed text alone. Children learn from their experiences and should be given the opportunity to share those experiences with others.



Adequate Time

There never seems to be enough time in the day for students to learn what needs to be taught. However, teachers must allow adequate time for students to complete projects, participate in meaningful discussions, and reflect on their learning. We must model "quality vs. quantity" as students participate in activities. Teachers must allow for the teachable moment as it presents itself in the classroom. If we are truly allowing students to learn through discovery, there will be many teachable

moments that arise. Teachers must realize it is appropriate to skip a planned activity if the teachable moment is relevant to the activity in progress and the students are truly involved in learning. We must continually remind ourselves of the saying, "Less is More." Students will retain what they learned and have a more positive learning experience if we don't try to force too many concepts into a day of learning.

Multitasking

How can we manage to teach all that is required for students to learn and keep a stress free environment for our students? Multitasking allows for multiple activities to take place at one time, integration of technologies, implementation of flexible grouping, and the teacher to be a facilitator. As you visit a classroom where students are involved in active learning, you will undoubtedly see multitasking taking place. Multitasking in a classroom setting refers to the ability for groups of students or individuals to be working on different projects/activities in different areas of the classroom at the same time. Multitasking allows for two things to happen in the classroom. First, it allows students to complete tasks according to their learning style and gives them a variety of activities to participate in to accomplish a goal. Secondly, multitasking allows the teacher to maximize the effectiveness of teaching. As brain research has shown us, not all students learn the same way. Teachers must offer a variety of tasks for students to achieve the goals that are expected of them. Multitasking allows the teacher to maximize the effectiveness of teaching. If all students are doing the same activity at the same time, there will be moments when the teacher is not needed and other moments when the teacher gets frustrated being unable to help everyone. Using multitasking in the classroom allows the teacher to make better use of time as a facilitator of learning. While the teacher monitors and instructs various groups, students benefit from the small group instruction.

As a teacher beginning to make the transition from the traditional classroom setting to one that enables active learning, you may find the following information helpful in managing multitasking in your classroom. The main key for successful management of multitasking instruction lies in clarity. Students must have a clear understanding of appropriate behaviors, tasks, and where they can turn for help if problems develop. This is not different from any traditional classroom, however in a multitasking environment students have to take more responsibility for their behavior and learning. They should rely on their peers as well as their teacher for assistance. Teachers need to provide adequate time for the tasks and should try to eliminate rigid blocks of times. Time should be built in for student sharing and the teachable moment that arises as the teacher monitors each group. While the groups are working, the teacher should ask questions to stimulate the learning that is going on in a particular group. If the teacher sees a problem developing, first let the group members try to solve it themselves before intervening. In summary, the

teacher in a multitasking classroom becomes a(n):

☑ **Observer:** listens to discussions from a distance and asks key questions to stimulate thinking
☑ **Monitor:** acts as a coach and focuses on interacting rather than intervening whenever possible, establishes a signal for noise control
☑ **Organizer:** makes a T-chart for both social and academic criteria, sets time limits for tasks, and adds additional minutes to lessons when needed
☑ **Encourager:** encourages critical thinking and creativity from all students and gives positive feedback

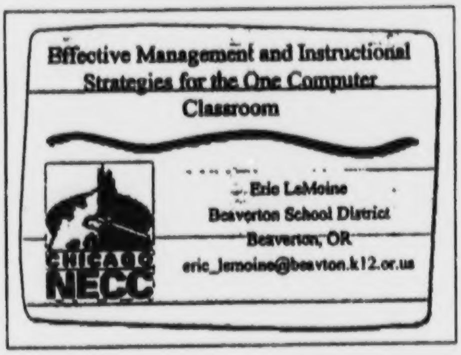
The physical arrangement of the classroom is very important. The classroom must allow space for group projects, individual work space and multimedia capabilities. If the multitasking environment is to be successful it must be an enriched place for students to immerse themselves in reality. The environment should provide hands on opportunities, provide books, reference materials, and access to various technologies. With this enriched environment in mind, a multitasking classroom will prepare students for real-world roles by teaching them how to participate in discussions, plan and carry out tasks, and feel comfortable using technology.

Varied Assessment Strategies

With multiple activities integrated into the curriculum, teachers must also focus on using a variety of assessment strategies. Standardized assessments are meant to be used as a diagnostic tool for the teacher. Because these types of tests limit the student's ability to apply knowledge in a real-world situation, they should only be used to determine the student's ability to perform a specific task. Alternative assessments allow students to create a response to a given situation by giving a short answer, oral presentation or other responses that allow for student explanation. Performance assessments are a final type of assessment that allows a teacher to observe and evaluate actual student performance of a specific task.

With each of these key elements implemented in classrooms, student success is not far behind. As teachers' roles change, so must the total classroom environment. Choosing one or two of these elements won't make for a successful learning environment. Each teacher's goal must be to work toward embedding all the key elements into the classroom. The teacher and the students will benefit from this engaging environment.

HyperQuests: Interactive, Student-Centered Guided Activities - Involve Your Students Today!
Jim Hirsch - jhirsch@pisd.edu



Effective Management and Instructional Strategies for the One Computer Classroom

Eric LeMoine
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Beaverton, OR
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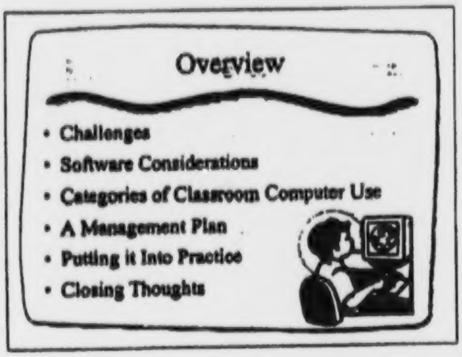
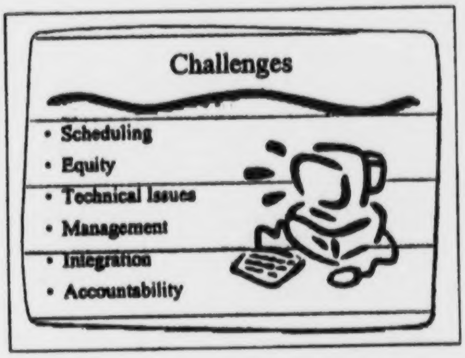
CHICAGO NECC



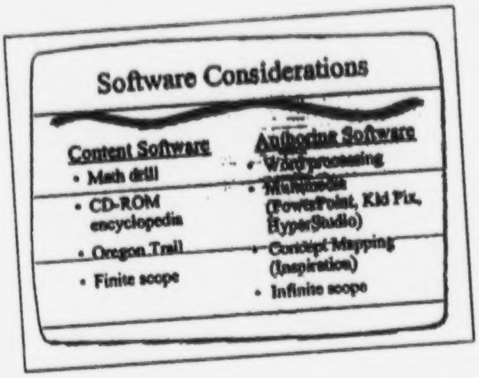
Overview

- Challenges
- Software Considerations
- Categories of Classroom Computer Use
- A Management Plan
- Putting it Into Practice
- Closing Thoughts



Challenges

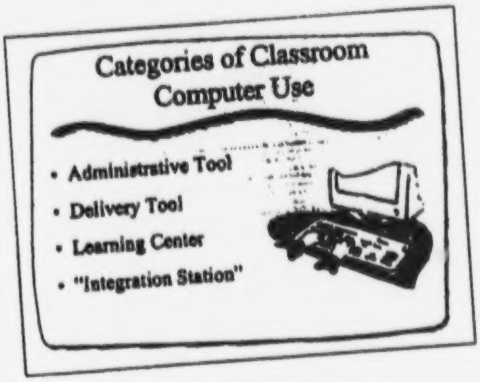
- Scheduling
- Equity
- Technical Issues
- Management
- Integration
- Accountability



Software Considerations

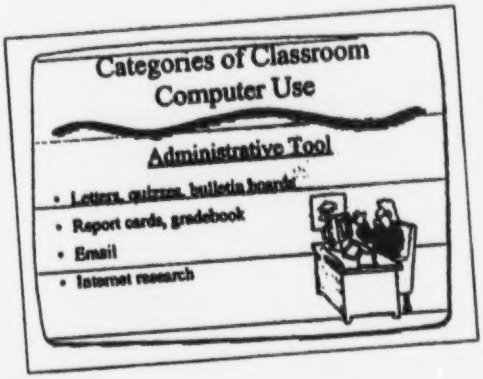
Content Software
- Math drill
- CD-ROM encyclopedia
- Oregon Trail
- Finite scope

Authoring Software
- Word processing
- Multimedia (PowerPoint, Kid Pix, HyperStudio)
- Concept Mapping (Inspiration)
- Infinite scope



Categories of Classroom Computer Use

- Administrative Tool
- Delivery Tool
- Learning Center
- "Integration Station"



Categories of Classroom Computer Use

Administrative Tool
- Letters, quizzes, bulletin boards
- Report cards, gradebook
- Email
- Internet research

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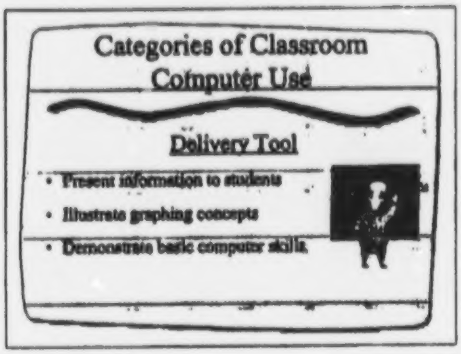
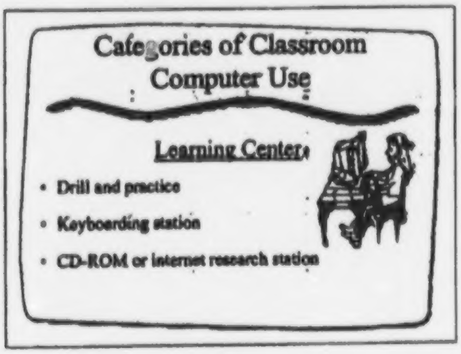


Categories of Classroom Computer Use

Delivery Tool

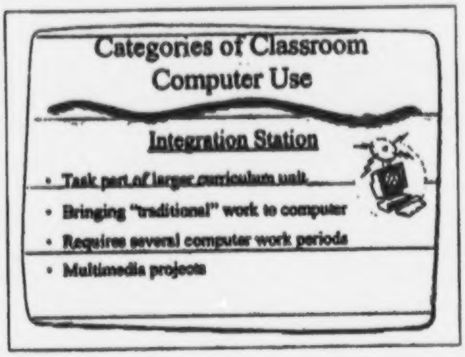
- Present information to students
- Illustrate graphing concepts
- Demonstrate basic computer skills



Categories of Classroom Computer Use

Learning Centers

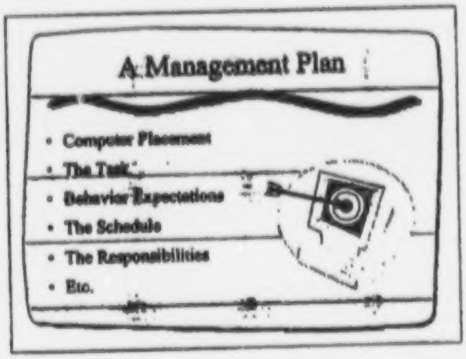
- Drill and practice
- Keyboarding station
- CD-ROM or internet research station



Categories of Classroom Computer Use

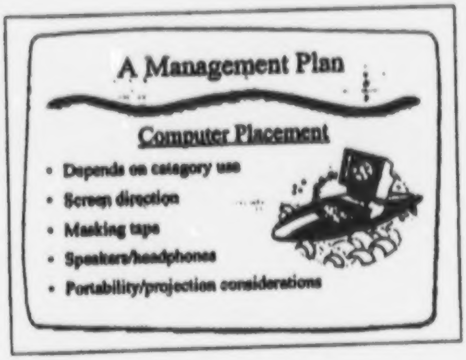
Integration Station

- Task part of larger curriculum unit
- Bringing "traditional" work to computer
- Requires several computer work periods
- Multimedia projects



A Management Plan

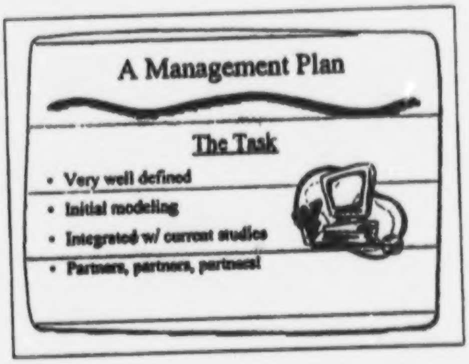
- Computer Placement
- The Task
- Behavior Expectations
- The Schedule
- The Responsibilities
- Etc.



A Management Plan

Computer Placement

- Depends on category use
- Screen direction
- Masking tape
- Speakers/headphones
- Portability/projection considerations



A Management Plan

The Task

- Very well defined
- Initial modeling
- Integrated w/ current studies
- Partners, partners, partners!

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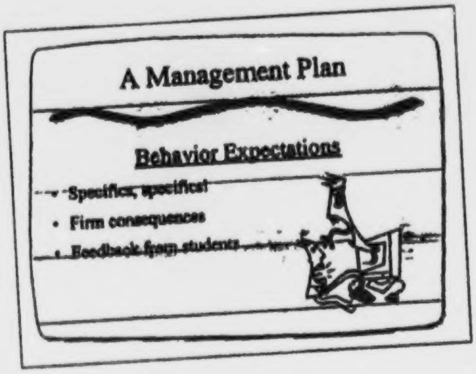
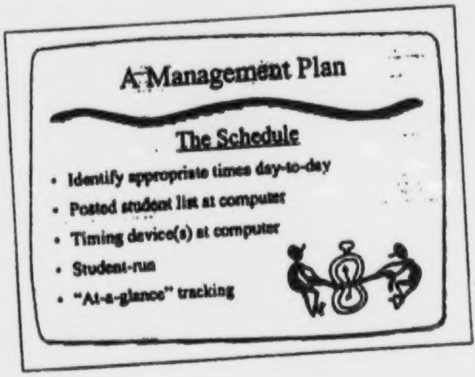


A Management Plan

Behavior Expectations

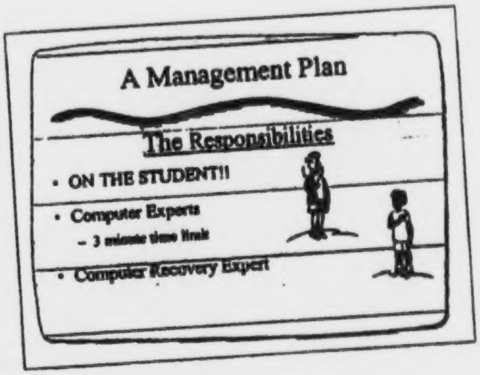
- Specifics, specifics!
- Firm consequences
- Feedback from students



A Management Plan

The Schedule

- Identify appropriate times day-to-day
- Posted student list at computer
- Timing device(s) at computer
- Student-run
- "At-a-glance" tracking



A Management Plan

The Responsibilities

- ON THE STUDENT!!
- Computer Experts
  - 3 minute time limit
- Computer Recovery Expert

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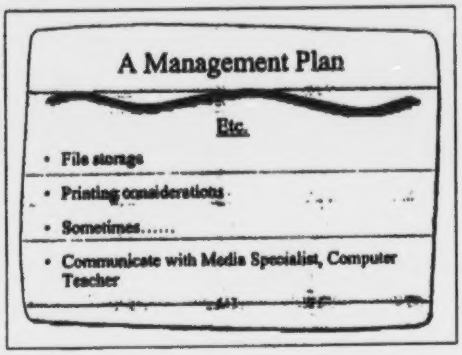
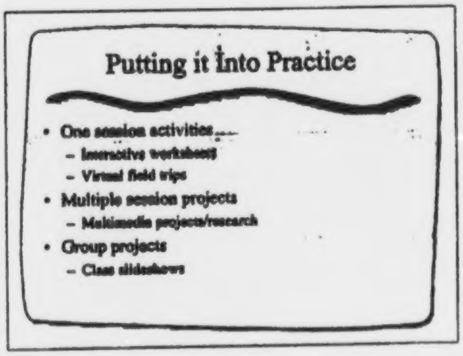


A Management Plan

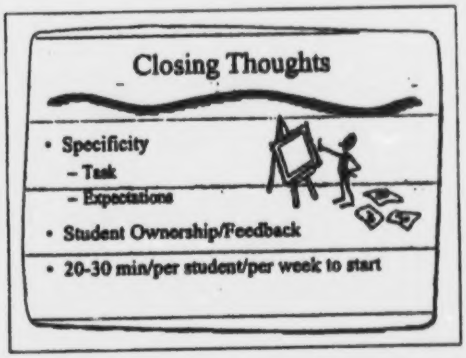
Etc.

- File storage
- Printing considerations
- Sometimes……
- Communicate with Media Specialist, Computer Teacher



Putting it Into Practice

- One session activities
  - Interactive worksheets
  - Virtual field trips
- Multiple session projects
  - Multimedia projects/research
- Group projects
  - Class slideshows



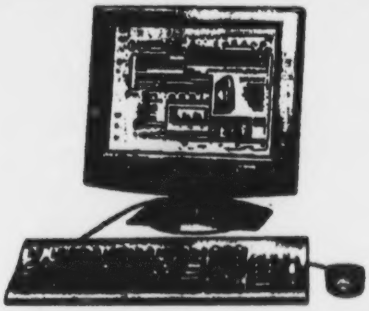
Closing Thoughts

- Specificity
  - Task
  - Expectations
- Student Ownership/Feedback
- 20-30 min/per student/per week to start

Thin Client @ School

The Critical Link

Whether you are in the business of creating educational software, training teachers, or running schools, thin clients may be the critical link between your services and the classroom.



In 1999, National Semiconductor launched the Thin Client @ School™ Initiative. The goal of the initiative is to increase the use of thin-client technology in K-12 education through partnerships, awareness, and installations at schools around the world. In 2001, the Thin Client @ School Contest awarded a complete thin-client computing solution to a school with an innovative and original plan for the technology. Through these activities, we've identified successful deployment strategies for schools and documented them on our web site: www.national.com/thinclient@school.

The term thin client refers to a growing class of devices that connect to application servers for functionality. The thin client requires minimal local computing power, and little if any local storage or local configuration. Most thin clients have a small, sealed case design without open slots and few, if any, moving parts to break down, make noise, or generate heat. Their small size works well with existing furniture and classrooms.

Technology Integration in Schools

National Semiconductor believes that educators can deliver on the promise of improving education with the aid of technology.

All too often, technology falls short of its potential because the end device fails. When computers require set-up, maintenance, and regular reconfiguration at the desktop, they become the Achilles heel of the technology solution. Companies, school leaders, and community members who provide software, training, and system support become frustrated and return to out-dated teaching tools.

Thin clients overcome these weaknesses. With thin clients on the desktop, technology is accessible, easy-to-use, and reliable. When information and applications reside on secure servers, information is portable from the classroom to the library to home. Students, teachers, and administrators can push the boundaries of learning to new heights.

Benefits of Thin Clients

✔ **Lower Cost**—Zona Research estimates that organizations can save 57 percent of their system administration cost over five years with a thin-client solution vs. a traditional computing approach. Because they use less energy and generate less heat, thin clients also reduce energy demands. Less money spent on support means more funds available for software and hardware purchases, training, and development.

✔ **Software License Management**—All software resides on servers where technology staff members can maintain and manage resources. Depending on application needs, servers may offer Windows NT®, Unix®, Linux™, or terminal emulator to access a broad range of software applications.

THIN CLIENT @School

www.national.com/
thinclient@school

About National Semiconductor

National Semiconductor is the premier analog company driving the information age. Combining real-world analog and state-of-the-art digital technology, the company is focused on the fast growing markets for wireless handsets; information appliances; information infrastructure; and display, imaging and human interface technologies.

With headquarters in Santa Clara, California, National reported sales of $2.1 billion for its last fiscal year and has about 10,000 employees worldwide. Additional company and product information is available at www.national.com.

National Semiconductor
The Sight & Sound of Information

Thin Client@School

Commitment to Education

In 1997, National Semiconductor launched a multi-million dollar initiative to train and encourage teachers to use the Internet in their classrooms. The company, which has a longstanding history of K-12 education involvement, has invested $5 million to train nearly 15,000 teachers and provide cash awards to teachers (and their schools) who are using the Internet effectively in their classrooms. National Semiconductor is a board member of the SchoolTone alliance and a long-time supporter of the Internet Institute for Teachers at the Santa Clara County Office of Education.

✔ **Quick and Easy Deployment**—When IT staff deploy upgrades and new applications on the server, the updates are immediately available to all thin clients without hardware upgrades.

✔ **Reliable End-user Devices**—Thin-client hardware rarely fails and never requires local system or application reboots. Industry studies recommend replacing traditional desktop computers every three years compared to five to seven years for thin-client devices.

✔ **Easy Teacher Training, Planning**—Unique log-ins give teachers and students access to the same desktop, everywhere. Whether connecting in the classroom, the media center, or from home, they see the same information.

✔ **More Secure**—With regular backup of servers, all data is recoverable and secure, making thin clients an excellent administrative technology tool.

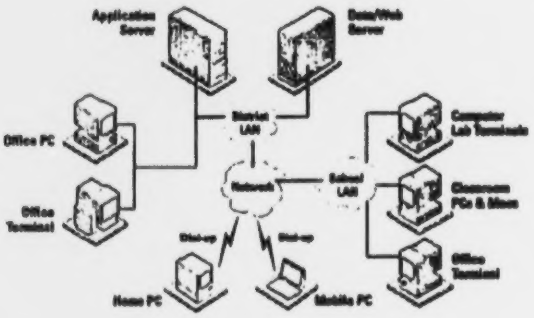
Thin-Client Migration

A typical school migration to thin-client computing might start with the purchase of application servers and thin clients for a lab or group of classrooms. Once thin-client servers are installed, older machines throughout the school can connect for access to current applications. As older machines fail or funding is available, the schools add more thin clients. A district also may implement thin clients in administrative offices.

Getting Involved

The Thin Client ● School Initiative demonstrates optimal thin-client solutions for K-12 education settings. National Semiconductor has partnered with technology companies and integrators to support pilot projects in the U.S., Germany, China, and other countries. To learn more about thin-client technology and competitive advantages in the education market, please contact thin-client@nsc.com.

School District Network Using Thin Clients



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Lemon Grove Elementary School District

Lemon Grove, California

Lemon Grove Elementary School District, an urban district with eight schools near San Diego, California, has become a national model of technology integration and community access. The LemonLINK project combines innovative technology deployment under the leadership of Darryl LaGace, Director of Information Systems, with comprehensive professional development and curriculum reform led by Project Director Barbara Allen. The combination of the right tools and the right people resulted in improved learning for students and a more satisfying work environment for teachers.

Ubiquitous Access

Lemon Grove serves a low-income family community near San Diego with 30,000 residents. Several years ago, a survey of parents revealed that just 16 percent of students had home computers, and only seven percent of those had Internet access. To turn around the low performing schools, the district needed a new approach to classroom teaching supported by more access to learning tools and teacher training to integrate these resources. Lemon Grove School District sought an affordable, reliable solution to connect both classrooms and homes to meet their learning goals.

LaGace recognized the benefit of a server-based solution centralized at the district office where he could keep application software up-to-date, provide regular backup services, and keep the whole system running. When he reviewed desktop options, LaGace determined that just the setup of PCs took 75 compared to 15 minutes for thin clients. Installing 100 units would take 15 FTE days vs. three FTE days with thin clients. The time savings were significant, and easy setup enabled the school to offer a low-cost home connection to parents.

"The reality is that we were seeing savings anywhere from 50 – 75% for technical support costs by deploying thin client technology," says LaGace.

Thin-Client Solution

The district serves two middle and six elementary schools linked by a high-capacity wireless backbone using microwave links. Each classroom has eight to 12 thin clients located on tables for student access throughout the class period. The change in setup enables instructors to move through the room offering assistance and students to engage in self-directed learning. An assignment on India once required students to share a few library resources. Now they all have simultaneous access to instructor-selected Internet resources for research and reports.

Lemon Grove leverages their investment in bandwidth and a server farm (35 servers, scaling up to 50) by offering inexpensive access in the evenings to students from home, and support to 14 community sites such as city hall, the fire department, and senior centers. The whole system is supported by one IT director and 5 technicians.

THIN CLIENT @School

www.national.com/
thinclient@school

Study Details

Students: 4,600

Teachers: 250

Schools: 8

Devices: 2,000 devices, Wyse Winterm™ Windows®-based terminals

Server: 35 server farm running Citrix® MetaFrame™, Microsoft® Windows NT® Server 4.0, TSE, and Microsoft Windows 2000

Network: wireless fiber optic WAN using microwave links, cable modems in homes

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Lemon Grove Elementary School District

Applications:

Microsoft Office 2000

Internet Explorer

CCC curriculum basic skills software

WiggleWorks literacy program

ProQuest Direct

Encarta

"We currently have 2,000 thin clients on our network and about 1500 legacy computers," says LaGace. "We have 5 technicians who support the entire system. One technician supports all the thin clients, and the other four are out there struggling to keep the legacy systems up and running to optimal performances."

As Lemon Grove rolled out its technology plan, they made an extensive training commitment to teachers. Each teacher receives regular training and support to integrate the technology into their curriculum, and assessment software helps everyone track the students' progress. Teachers go through the training in teams, sharing curriculum, coaching, and other successful strategies.

Conclusion

The vision held by these technology leaders matched by support at all levels of the organization has had impressive results. IT support costs are down by 50 percent and the performance of educational applications has improved 60 percent. Teachers have put off retirement plans, and new teachers seek out Lemon Grove School District. They spend more time interacting with students and each other. Reading and math scores have improved significantly for students participating in the program compared to those who have not yet have the opportunity.

"I have the opportunity like I've never had before in my classroom to make kids independent learners," says classroom teacher Jess Johnson. "The technology gives me the opportunity to really ask them, What do you want to learn?, and then set about that task of learning on their own. And that's very exciting to me. In the past you've always been limited to what resources you can check out of the library, and what text books are available."

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tm

Expand Access without Breaking the Budget

Karen R. Greenwood, Nimble Press
Shelly Luke, Eyes on the Future

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Expand Access, Don't Break the Budget

Teach

Scale

Deliver

Home

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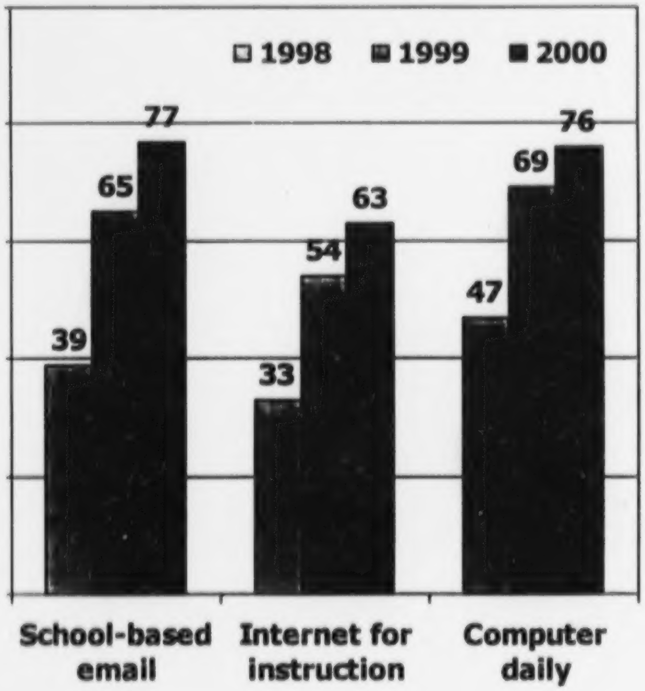
Teach At the Learning Moment

- Teachers use the Internet.
- Computers in the classroom.
- Improving quality of software and content.
- **Consistent, reliable access where they work: classroom, home, workroom.**

Percent of schools where 50% of teachers use...



Source: Education Week, May 2001.

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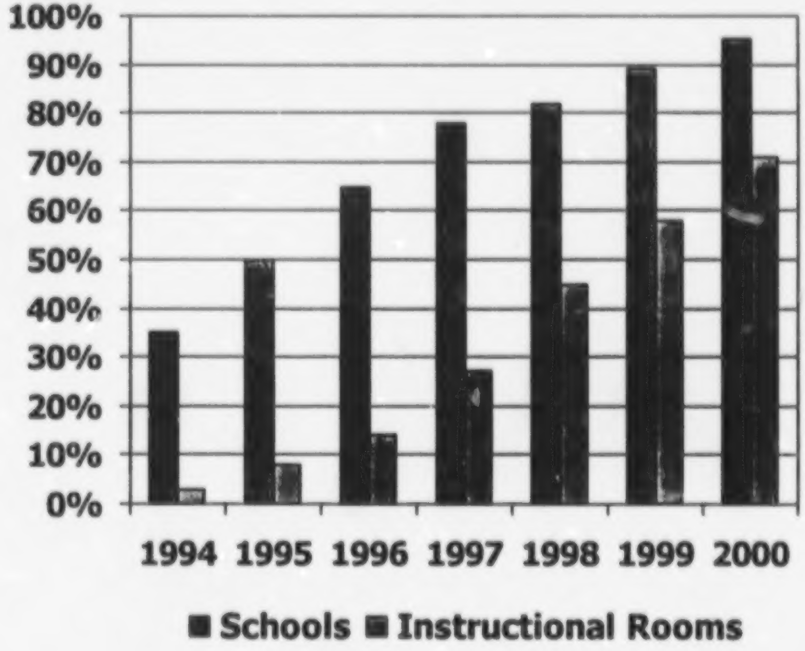
THIN CLIENT

How Do You **Scale** Up without Staff?

- The network is there, turn up the access.
- 72% of teachers who use the Internet have access in the classroom.
- **Integrated server-based solution with low maintenance.**

Internet Access



Source: ED s Internet Usage in Public Schools 2000, 4th Edition. U.S. Dept. of Education figures for 1994 and 1995 Instructional Rooms.

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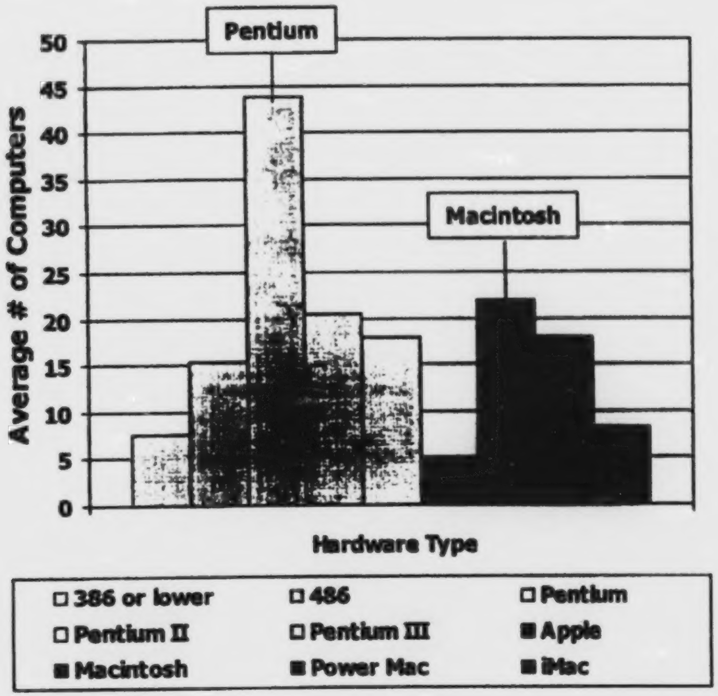
Where is the Machine to Deliver?

Hardware Install Base in SCHOOLS



- Install base of 8.6 million.
- Schools plan to purchase 23 Windows PC and 8 Apple/Macs.
- How will they integrate with legacy equipment?
- **Schools support multiple brands, software versions, need compatible solution.**

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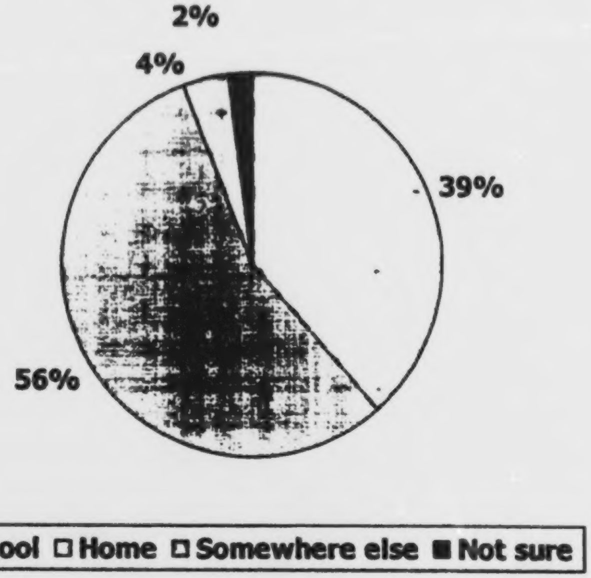
Why Should Schools Offer A Home/School Connection?

- 88% of students believe computers to be extremely or very important to success in the workplace.
- 40% of students believe computers to be extremely or very important to success in school.
- **Schools need access to where learning occurs.**

Where Have You Learned the Most about Using Computers?



Source: Education Week/MDR/Harris Interactive Poll of Students and Technology, May 2000.

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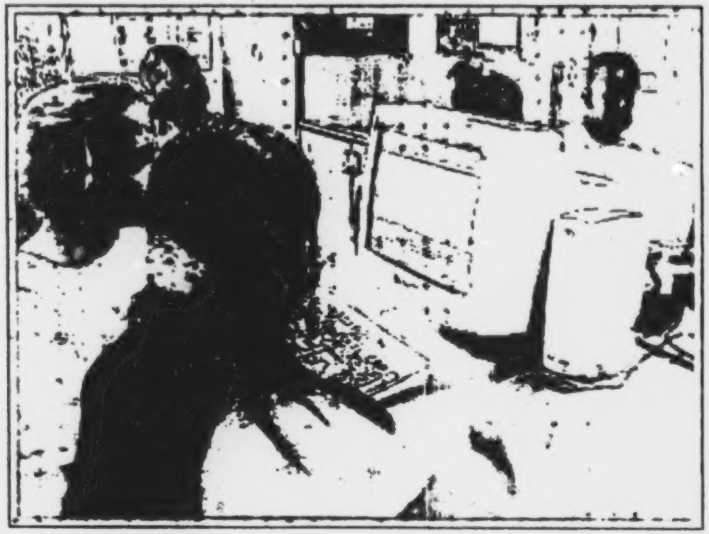
Lemon Grove School District

...All students are problem solvers, innovators, and users of technology. They are skilled communicators who are proficient in reading, writing, and speaking...



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Lemon Grove School District

- Diverse community, population 30,000, 8 miles east of San Diego, California
    - 65-75% of students on free or reduced lunch program
    - 17% are English learners, speaking over 20 languages
- Needed integrated technology in 8 schools serving 4,600 students in 180 classrooms
- Home/school connection: only 16% of students had a computer at home and 7% had Internet connectivity

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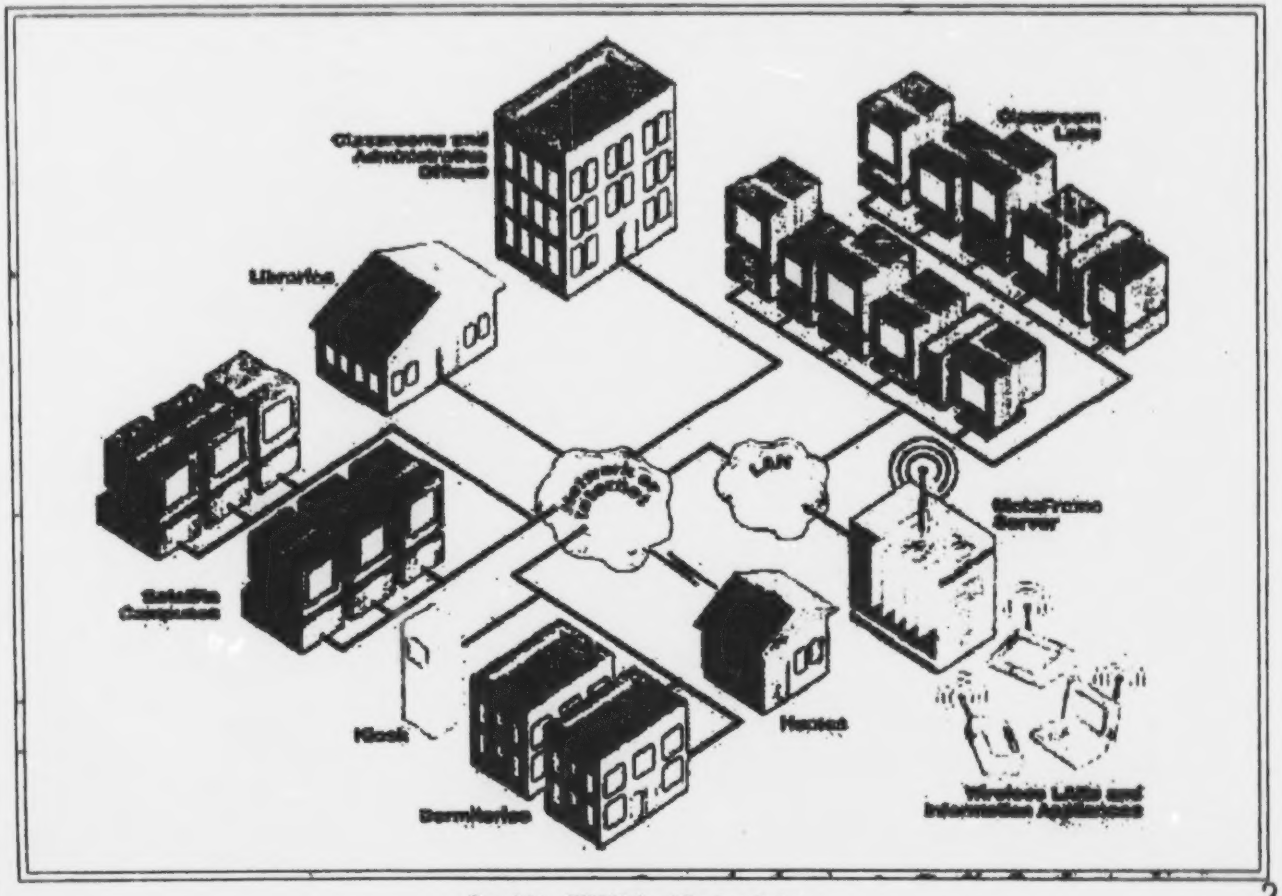
Thin-Client Server Solution


Classrooms and Administrative Offices
Classroom Labs
Libraries
Network or Internet
LAN
MetaFrame Server
Satellite Campuses
Homes
Kiosk
Dormitories
Wireless LANs and Information Appliances

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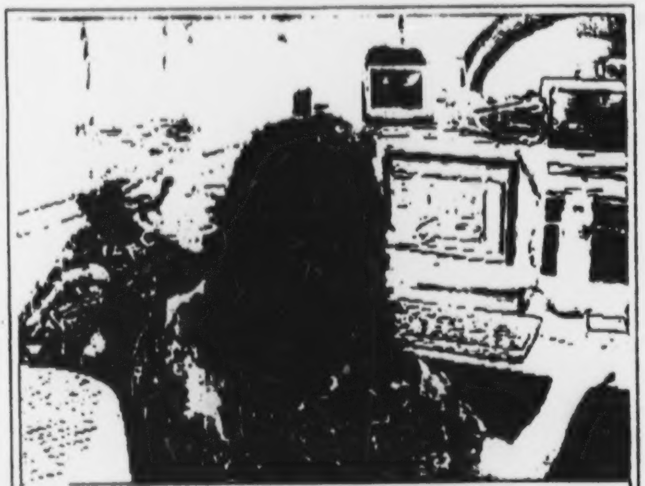
Lemon Grove Support Plan



Teachers receive 40 hours of training prior to receiving equipment in their room.

- In-house design, business partnerships, outsource network maintenance.
- District information services becomes community learning services.
- Sell services to city to fund program.
- 1 technician for thin clients, 4 support legacy machines.

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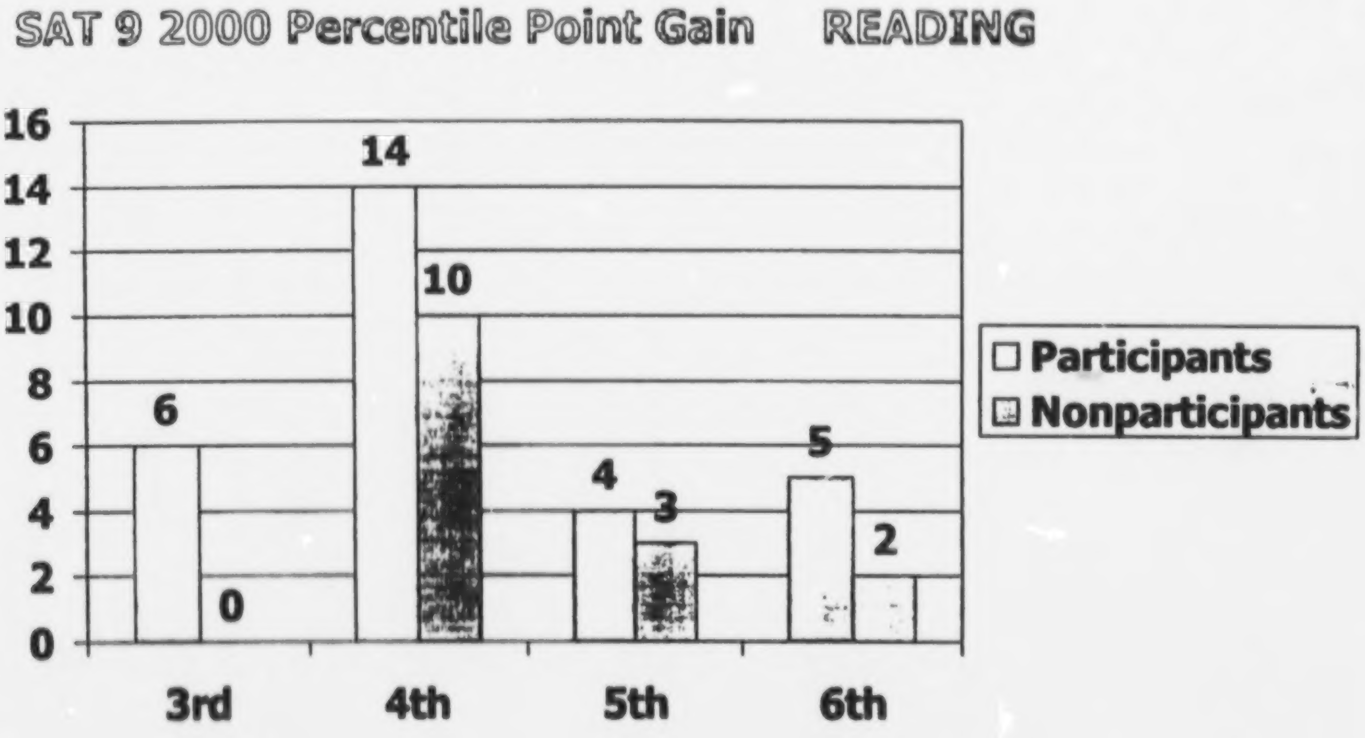
Lemon Grove Reading Results



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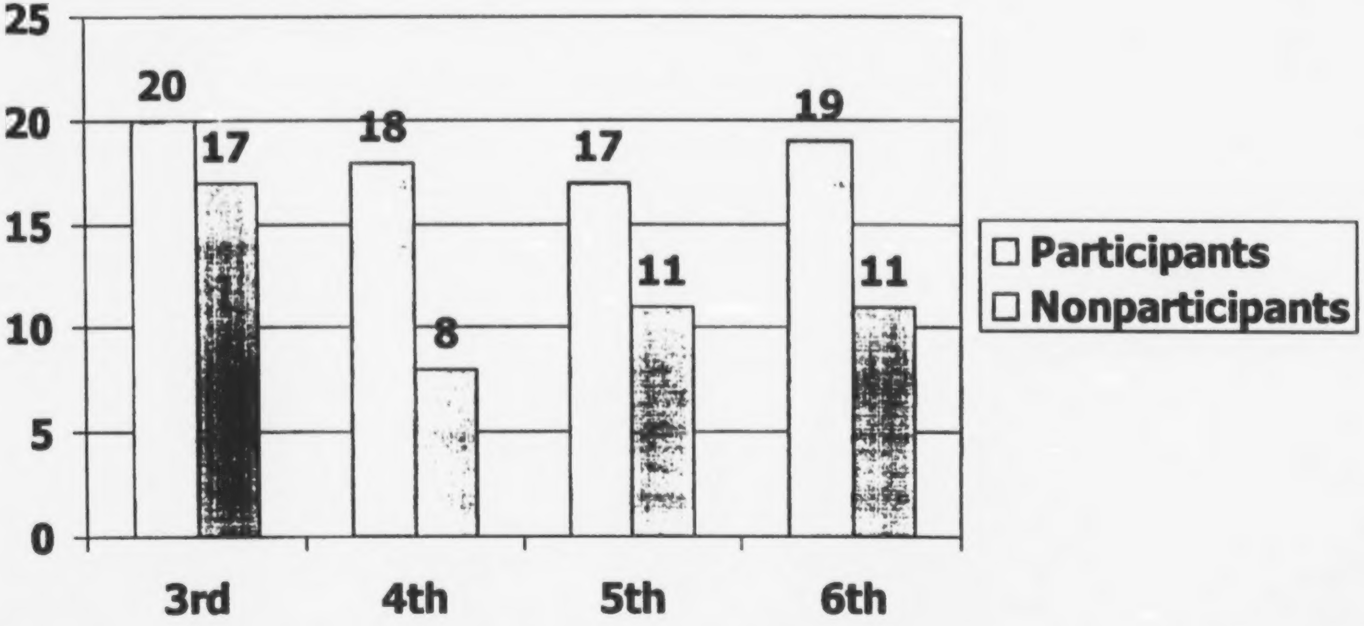
Lemon Grove Math Results

SAT 9 2000 Percentile Point Gain MATH



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Lemon Grove Solution

- Improve teacher retention by improving work environment and access to resources.
- Scale up to 2:1 student to computer ratio.
- Deliver reliable consistent desktop to all users, everywhere.
- Integrate solution into community and offer low-cost, low-maintenance for home use.

http://www.national.com/appinfo/thinclient/SuccessStories.html

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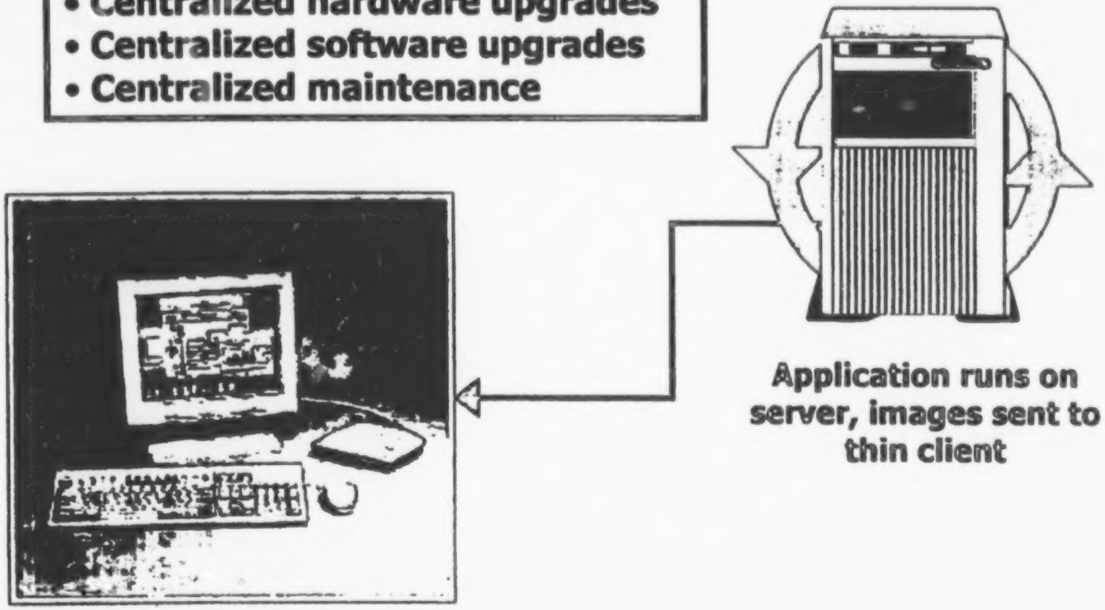
Emerging Technology: Thin-Client Computing

- **Centralized hardware upgrades**
- **Centralized software upgrades**
- **Centralized maintenance**



Application runs on server, images sent to thin client

Images display on thin client, keystrokes and mouse clicks sent to server

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Thin Client Information Appliances

Many new flavors to choose from...

- Windows-based with some applications on board
- Linux-based terminals
- Terminal emulators for access to legacy applications and data plus latest software.
- Wireless and handheld WebPAD tablets
- Terminals for the home

http://www.national.com/thinclient@school/vendors

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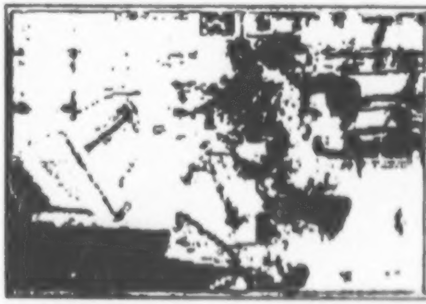
Benefits of Thin Clients

- ☐ Lower total cost of ownership by 50%
- ☐ Centralize maintenance and support
- ☐ Reliable and durable devices
- ☐ Leverage existing infrastructure
- ☐ Access to current software on clients anywhere
- ☐ Secure servers



Students at Jules Verne Oberschule, Berlin, Germany

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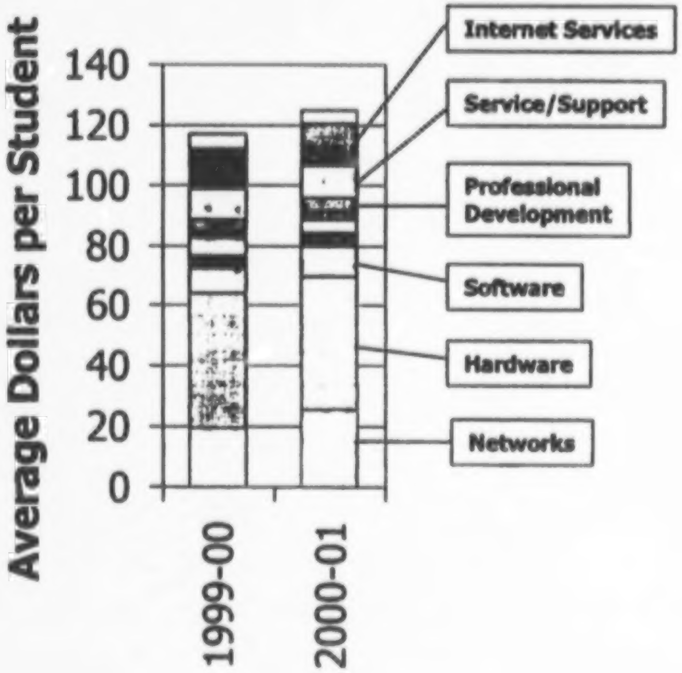
Tech Dollars Spent on Hardware

- Hardware remains the largest item at 37%.
- Internet services increased 107% between 1998-99 and 1999-00.
- Support, training, and professional development remain low.
- **Schools need low maintenance, easy-to-use, server-based solutions.**



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$50,000 Budget for Three Years

	Thin Client $500/device	**PCs** $1,000/device	**Laptops** $1,500/device
Servers	**$30,000**	**$10,000**	**$10,000**
New devices	**30 thin clients**	**30 new PCs**	**20 new laptops**
Legacy equip.	**30 PCs updated**	**30 PCs upgraded**	
Servers	**$20,000**	**$10,000**	**$10,000**
New devices	**60 thin clients**	**30 new PCs**	**20 new laptops**
Legacy equip.	**Update 30 PCs and 30 TCs**	**Upgrade 30 PCs** **Retire 30 PCs**	**Retire PCs**
Servers	**$15,000**	**$10,000**	**$10,000**
New devices	**70 thin clients**	**30 new PCs**	**20 new laptops**
Legacy equip.	**Update 30 PCs and 90 TCs**	**Upgrade 30 PCs** **Retire 30 PCs**	**Retire PCs** **Retire laptops**
TOTAL	**160 TCs, 30 PCs**	**60 PCs**	**40 laptops**

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Lemon Grove SD Thin Client Devices

Workstation

Unpack and load OS	30 min
Load applications	30 min
Configure network	15 min

Total per unit: 75 minutes

100 units = 15 FTE days

Thin Client (Wyse WBT)

Unpack and load OS	5 min
Load applications	5 min
Configure network	5 min

Total per unit: 15 minutes

100 units = 3 FTE days

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Portable Information, Access Everywhere

	Thin Client	**PCs**	**Laptops**
Purchase cost	$500/device	$1,000/device	$1,500/device
TCO/year	$2,500-5,000	$7,000-10,000	$10,000-13,800
Applications & information	Secure, updated, central control	Some control, not secure	No control
Long-term investment	Add devices	Upgrade	Replace
Durable	No moving parts 300,000 hours MTBF	Fans, drives 20,000-40,000 MTBF	Fragile equipment
Access everywhere	Lots of devices, one log-in	Some devices, many log-ins	2-8 pound machines

MTBF=Mean Time Between Failure Rate

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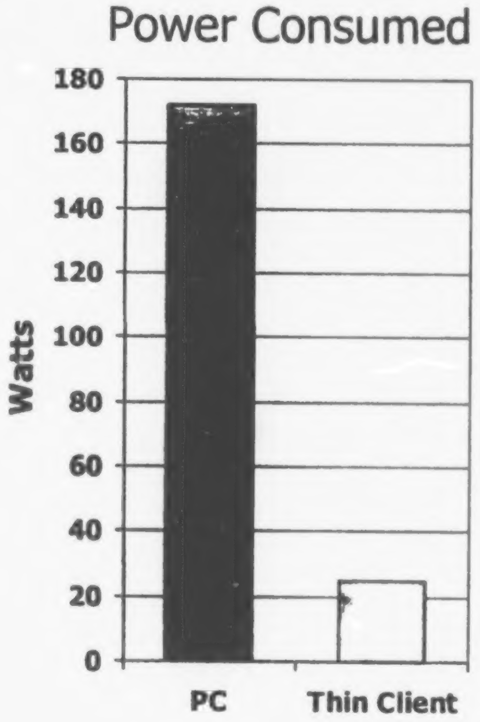
Save power, save money

- Thin client and server combined use 1/6th the power of a PC.
- Increase Internet access without electrical changes.
- Reduce power needs and costs.


Power Consumed

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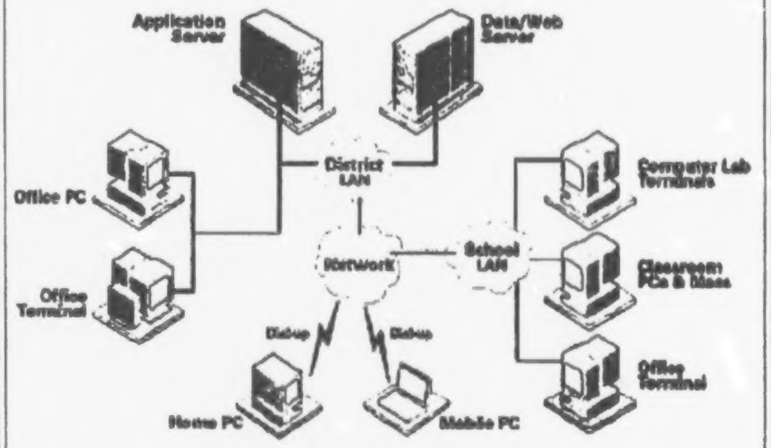
Thin-Client Network

- Application servers: Citrix, Microsoft 2000, Terminal Services, Unix, Linux, etc.
- Reliable Ethernet network
- Windows, terminal, or browser-based applications
- All desktop devices can connect: thin clients, PCs, Macs, laptops, etc.

School District Network Using Thin Clients


Application Server
Data/Web Server
Office PC
District LAN
Computer Lab Terminals
Office Terminal
Network
School LAN
Classroom PCs & Macs
Dial-up
Dial-up
Office Terminal
Home PC
Mobile PC

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Strategic Advantage for Educators

	Tactical with PCs	Strategic with Thin Clients
Site staff	Reboot machines Load software Reconfigure desktops Solve user-introduced problems	Create curriculum-based web pages Evaluate software Research materials Train teachers
District staff	Travel to sites Troubleshoot desktop hardware Manage software licenses Configure new machines	Provide remote support Monitor network and plan for expansion Review hardware and software developments for most effective solutions

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Union City School District

- Most densely populated city in the US 67,000 people in 1.4 miles
    - 92% are Latino and 75% do not speak English at home
    - 14% of students have been in the US less than 3 years
- 1989: failed 44 of 52 efficacy standards
- Radical reform of curriculum, school day, training, and technology infusion.
- Ubiquitous computing and a complete network to serve 11 schools, 10,500 students, 1,100 teachers

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Union City Students Succeed

- Test scores rose to equal to or above state average in elementary and middle schools.
- AP enrollment increased from 25 students in 1994 to 146 in 2000.
- 80% of students pass the state high school proficiency test.
- Fivefold increase in the number of students accepted to colleges and universities.

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Thin-Client Infusion

- Outsource implementation, maintenance, support and training to integrator with education solution: ClassLink Technologies
- Model in two schools: Edison Elementary, Emerson High School
- Student portfolios and applications on a 13-server farm with home access.

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Union City Solution

- Provide computers for teachers in exchange for email mentoring.
- Scale up to 3:1 student to computer ratio.
- Deliver access to portfolios anywhere to encourage continuous work.
- Email mentoring connects teachers and students from Home.

http://www.national.com/thinclient@school/SuccessStories.html

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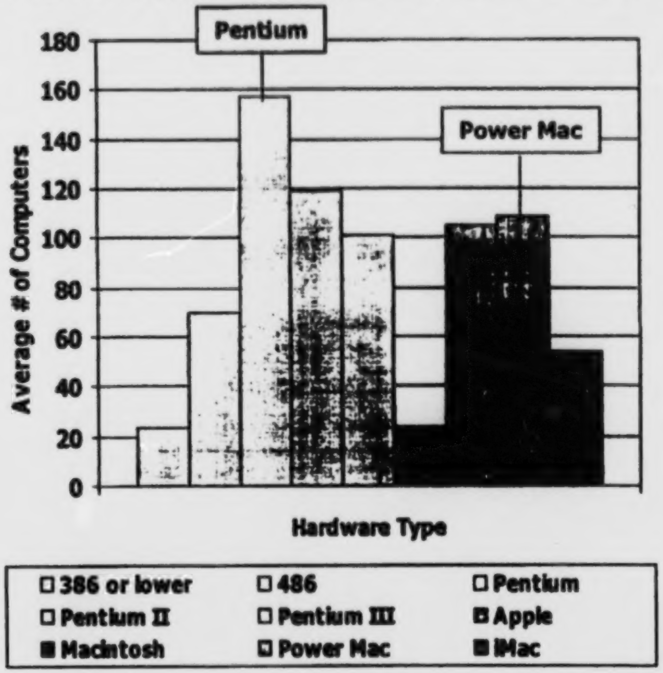
Scale up at the District Office

Hardware Installed Base DISTRICTS



- Windows PCs account for 75% of planned purchases for 2000-01, up from 70%.
- Install base is older Pentium and Mac, not Windows 2000 capable.
- **Districts must use scarce funds to replace older hardware or make install base compatible with new.**

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Thin-Client Solution

- Teach
  - ✓ Maintenance, upgrades, support centralized
  - ✓ No need for teacher to provide desktop support
  - ✓ Home access to applications, data, and Internet
- Scale by building on infrastructure investment
- Deliver consistent, reliable access everywhere
- Home access for teachers, students, and administrators link community to the school

http://www.national.com/thinclient@school

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Resources

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Extra Foils

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Union City School District

Union City, New Jersey

In 10 years, Union City School District went from one of the worst performing districts in New Jersey to graduating university-bound students. Innovative technology provided the backbone to radical restructuring of the curriculum, instruction practices, and even the classroom environment. Thin clients were deployed in two of the 11 schools to enhance learning and relieve the district of the technology management burden.

New Technology for a New Approach to Learning

There is a school every four blocks in Union City, New Jersey, population 67,000. More than 10,000 students live within the most densely populated city in the U.S. The majority of students (92 percent) are Latino; 75 percent do not speak English at home; and 14 percent have been in the U.S. for less than three years. In 1989, the school district failed 44 of 52 state school efficacy indicators such as student attendance, drop out and transfer rates, and scores on standardized tests.

The school board took action before the state took control. They promoted Tom Highton to Superintendent and Fred Carrigg to Executive Director for Academic Programs. They brought top teachers and administrators together in a reform committee to review programs, research learning techniques, and plan a technology infusion.

"I can't imagine adding technology in a meaningful way without reforming curriculum," says Fred Carrigg, Executive Director for Academic Programs. "If curriculum is based on rote learning, use of technology will be mundane. If curriculum is based on student inquiry, synthesis, and evaluation, the uses of technology are more likely to be imaginative and to support progressive approaches to learning."

Changes in the curriculum to be more adaptive, localized, and promote team teaching required access to communication tools. The reform committee set their sites on a district-wide network and ubiquitous computing tools.

Five years into the reform, the cost to maintain and support the technology began to drain resources away from other programs. Teachers experienced delays when machines crashed and lost time fixing computers. District leaders, education experts, could barely keep pace with changes in technology, yet they knew technology advances could support their vision of a more reliable system at a lower cost.

Thin-Client Solution

The school district contacted ClassLink, a leading integrator specializing in educational thin client implementations. ClassLink suggested a thin client, server-based computing solution for implementation in two schools: Edison Elementary School and Emerson High School.

ClassLink built servers to meet the district's specifications, provided maintenance, and offered workshops to train teachers. The district no longer has to worry about bits, bytes, and network throughput. They leave that up to ClassLink. After just two years, their support costs have dropped, and the district plans to move all elementary schools to thin client.

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www.national.com/
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Study Details

Students: 10,533

Teachers: 1,100

Schools: 3 elementary, 5 K-8, 1 middle, 2 high schools

Edison Elementary and Emerson High Schools

Devices: 400 stations, including 200 thin client terminals

Server: 13 servers

Applications: Microsoft Office, Netscape Navigator, Internet Explorer

Network: Fiber backbone, switched 100mb to the desktop.

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Union City School District

In 1998, National Semiconductor launched the Thin Client @ School initiative. The goal of the initiative is to increase the use of thin-client technology in K-12 education through partnerships, awareness and installations at schools around the world. These activities have included successful deployment strategies for schools, documented on the web site:

www.natioal.com/
thinclient@school

Access Anywhere, Learning Everywhere

A high-speed, district-wide technology infrastructure now connects all classrooms with voice, video, and data through a fiber-optic backbone and T-1 lines. More than 3,600 instructional computers give the district a 3:1 students to computer ratio. Electronic portfolios, e-mail, and access to productivity applications give students and teachers alike the tools they need to develop literacy, communicate ideas, and facilitate cooperative learning.

"This isn't about technology," says Carrigg. "It's about education. With ubiquitous access to electronic folders, a student can work on a project in another classroom, a media room, the library, or even home. The quality of the portfolios is excellent. The portfolios follow kids for years."

At Edison, the technical support team has learned how to run the thin clients on their own through integrater-led workshops. Carrigg and his team plan to send every school through the same implementation process. He has confidence that the capable school staff can become effective technology facilitators using thin clients.

The new technology gives New Jersey students, teachers, administrators, and parents a portal to learning opportunities.

- E-mail and access to the internet gives teachers a tool for communicating about student needs and strategies, as well as access to the latest research
- Using modern computing tools and software applications helps inner city students compete with affluent suburban peers for four-year college spots and prepare for the working world
- Internet in the classroom gives students access to a wealth of information and experiences beyond the classroom and the neighborhood

Conclusion

Union City School District is a model in technology use and urban school reform. Elementary and middle school students perform equal to or above the state average on standardized tests. The number of high school students enrolled in advanced placement (AP) courses has increased from 25 students in 1994 to 146 in 2000. Eighty percent of students pass New Jersey's high school proficiency test and the number of students accepted to first- and second-tier colleges and universities has increased fivefold.

Carrigg is most proud of an innovative mentoring project initiated by the district to build relationships between faculty who live outside the city limits and students. In exchange for a home computer, a teacher or school administrator mentors up to 8 students.

"It has changed relationships between teachers and students," says Carrigg. "When you get scores of faculty involved, you're helping hundreds of students have relationships with educated adults outside the classroom vertical relationship of power."

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Thin-Client Solutions

For K-12 Schools

A National Semiconductor White Paper

THIN CLIENT @ SCHOOL

National Semiconductor

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Thin-Client Solutions for K-12 Schools

A National Semiconductor White Paper

Executive Summary

Most schools today regard integrating technology into the learning process a critical priority. Nearly every school in the country has access to the Internet (95 percent of public schools as of 2000[1]), with the number of computers available for students and educators increasing each year. As access expands, the long-term costs for maintaining, updating, and managing technology spiral out of control. Schools need an affordable solution to today's demand for reliable, consistent access to technology for learning. This white paper examines the barriers to affordable technology for schools and reviews thin-client technology as one solution to the problem.

The idea behind thin-client computing is simple: centralize computing power, storage, applications, and data on servers (powerful computers) and provide users with an inexpensive client device that is easy to install with all maintenance and updates handled from the server. The client connects to the server through the network to process applications, access files, print, and perform services available to ordinary computers. "Fat clients" differ from thin clients in that they require substantial memory and computing power to keep up with regular updates of software. Schools invest in both the desktop computers and the network resources. Thin clients have a single point of administration and investment at the server. Other unique features of thin-client devices provide clear benefits to schools:

- Industry case studies show that thin clients require fewer staff to manage more machines, significantly reducing the Total Cost of Ownership (TCO) of technology.[2]
- Centralized data and processing enables educators to control student access to applications and other resources. Software updates extend to every client computing device at once, eliminating version control and licensing problems by centralizing distribution from the server. Consistency of resources available on all machines improves the delivery of professional development training.
- Reliable access to applications and data from all types of clients means that teachers and students can share information seamlessly. They spend less time troubleshooting and setting up computers, leaving more time for teaching and learning.
- With processing power and storage centralized on servers, schools can leverage existing hardware, running the latest applications on servers connected to all types of computers.
- The robust thin-client design protects from viruses, lowers risk of theft, and makes backups feasible.
- Shadowing allows educators or technical support staff to control a desktop remotely to assist students or others. Because all processing is done on the server, no additional network resources are required for shadowing.

This paper focuses on Windows®-based terminals (WBT), thin-client devices designed to display a Windows environment on the desktop when connected to thin-client servers. WBT thin clients can be incorporated into the school computing infrastructure and offer access to familiar classroom software. In this environment, servers connect over existing networks to optimized thin-client devices as well as legacy computers to provide a standard set of current applications throughout the school.

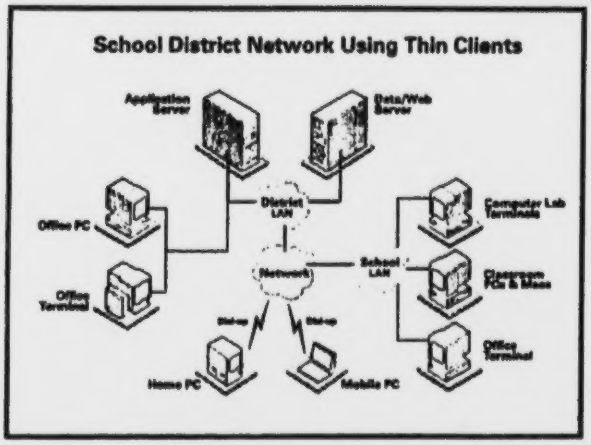
---

1) U.S. Department of Education, National Center for Education Statistics, February 2000.

2) Zona Research and the GartnerGroup have shown this through studies of multiple firms. Federal Express and National Semiconductor also have published case studies.

Thin Clients: A New Horizon on the Desktop

A thin-client computing environment consists of an application server, a network and thin-client devices. The workhorse of the setup is the **application server**, a computer (or computers) with enough processing power and memory to serve all clients and their application needs. Windows-based terminals require either Microsoft® Windows NT® 4.0, Terminal Server Edition, and Citrix® MetaFrame™ to run the thin-client protocol based on Independent Computing Architecture (ICA®) or Microsoft Windows 2000™, Terminal Server Edition, to support Remote Display Protocol (RDP™). If remote servers are used, a local PC can be installed for booting up the thin clients and for backup DHCP services.



School District Network Using Thin Clients

The **network infrastructure** is the pipeline between the server and the client. Thin clients generally use standard Ethernet or telephone networks. Wireless models are increasingly available. Bandwidth needs vary depending on applications, number of concurrent users, and thin-client devices selected. Most thin clients use less bandwidth than traditional PCs because they transfer only mouse clicks, keystrokes, and screen images. Network reliability is key to enable rapid screen refresh. Some thin clients come with local boot options and limited native applications to make them less network dependent.

Thin-client devices represent a growing class of devices optimized for server-based computing. Smaller than typical desktop computers (about the size of a textbook), the "thinnest" thin clients have no moving parts. They contain a microprocessor capable of processing graphics, network interface capability, a video subsystem, and enough memory (at least 16 MB) to run system software to connect to the server. They do not need a hard drive, floppy drive, or CD-ROM drive. Most thin clients have a sealed case design without open slots. Thin clients last longer, use less energy, and upgrades can be downloaded from the manufacturer's web site. They have a locked down desktop to ease management with access to productivity software, web browsing, and many educational software resources. Depending on user needs, they come with different processing, memory, and application options.[3]

An alternative to purchasing and supporting the server and applications is to employ the services of an **Application Service Provider** (ASP). For an annual fee per user, the school can subscribe to a variety of software applications (instructional and productivity) and educational content resources through the ASP. The ASP owns, tests, upgrades, and maintains software applications and server equipment. The ASP centralizes the cost and complexity of managing and delivering applications and serves those applications over secure Internet connections to classroom and school computers. Costs are fixed at an annual service rate and lower than a more traditional computing environment, and there is less initial investment in on-site servers.

[3] For a detailed explanation of hardware and software requirements, see *Thin Clients Clearly Explained* by Joseph T. Sinclair and Mark Merkow (Academic Press, 2000).

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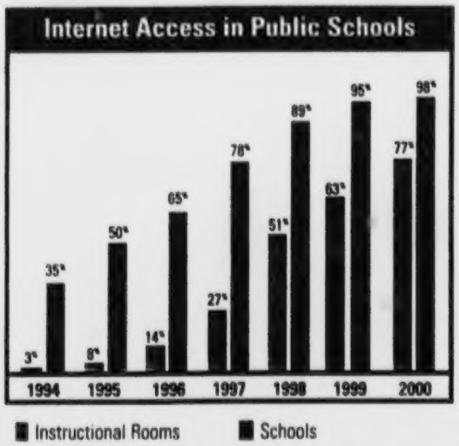
Budgeting for Technology

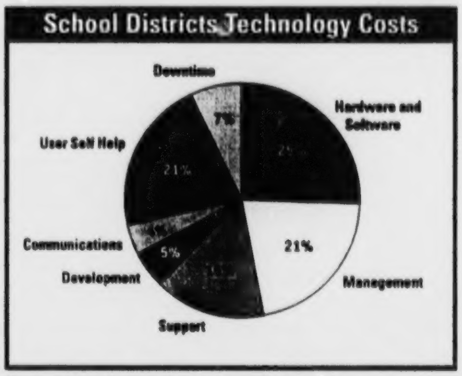
An administrator's first question about new technology is usually "how much will this cost?" The second one is "how does it fit with what I already have?" A third question should be asked as well: "who will support it?" The current model of individually supported desktop computers is not scalable from a computer lab to many classrooms. Most school districts lack the financial and human resources to support the increasing reliance on networked computers for everyday activities. Almost every school has Internet access, and the number of networked classrooms is rapidly rising.



Source: For 1994-1999 data, see U.S. Department of Education, National Center for Education Statistics, 2000. For 2000 estimate see QED's Internet Usage in Public Schools 1999.

As schools expand, access from a computer lab supported by a technology coordinator or special instructor to computers in every classroom at a ratio of four students per device, the cost for support and training will skyrocket. A total cost analysis for technology will come as a surprise for many organizations. First, most school districts only provide support for the initial setup. Teachers either spend their own time managing computers, students provide volunteer support, or when problems arise, computers go unused. Second, most classrooms have few, if any, networkable computers in them. For years, the computer lab managers have felt overburdened by the task of keeping computers running, and they are the true believers in technology. When problems arise in the average classroom, educators may become frustrated or discouraged with technology, abandoning their plans and returning to more conventional teaching methods. Rather than add more staff to support increased technology, schools can take advantage of technologies that reduce the number of hours it takes to support each machine and improve reliability.

Most educational technology budgets only address the cost of hardware and software acquisition, about 25 percent of the actual lifetime cost of technology. The true cost of technology over a five-year period includes more than just capital costs and typically breaks down like this:



Source: http://www.microsoft.com/education

Many organizations neglect to factor in management, support, development and planning, communication network costs, and lost productivity (user self help). Such costs may be difficult to measure in terms of dollars, but most educators can track the time they spend traveling to sites, loading software, diagnosing problems, and fixing them. As teachers adopt technology for their daily activities, they will require reliable

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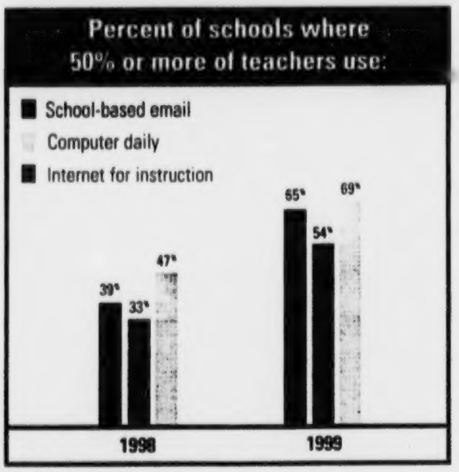
access, making the lack of support more apparent and putting pressure on an overburdened technology staff.

These hidden cost issues were first recognized in corporations and resulted in studies of the Total Cost of Ownership (TCO) of technology. The Consortium for School Networking began a Total Cost of Ownership project in 1999 and cites several TCO estimates in their white paper, "Taking TCO to the Classroom," (http://www.cosn.org/tco/project_pubs.html). Zona Research estimates that organizations can save 57 percent of their system administration cost over five years with a thin-client solution vs. a traditional computing approach.[4] Thin clients reduce maintenance, simplify upgrades, and improve security. The cost advantages occur in the following areas:

- As older, less reliable desktop computers are retired, they are replaced with low-maintenance thin clients.
- Installation of thin-client devices is a matter of plugging them in—no need to install software, change settings, or add hardware such as memory or Ethernet cards.
- Fewer staff can support far more clients in a thin-client environment.
- Thin clients require fewer upgrades and can be upgraded remotely without touching each device or opening the case to install new hardware.
- With fewer moving parts and no open slots, the device itself lasts at least twice as long as a typical PC.
- Reliable computing devices with a consistent look and feel will encourage more educators and staff to integrate them into their curriculum and daily work.
- With regular backups of servers, all data is recoverable and secure.
- Travel expenses and travel time of support staff are essentially eliminated through the use of remote management tools, shadowing, and local server maintenance.
- Software costs can be reduced through site licensing, concurrent licensing, and standardization. All devices with access to the thin-client servers can run current software. Usage can be tracked to determine whether applications should be upgraded or eliminated.
- Because thin clients are more reliable, users experience less downtime and self-administration.

A thin-client environment helps an organization rein in costs and keep them under control. Users at every site have equal access to applications regardless of their equipment. The cost of a thin-client solution, which supports all of the existing computers plus new thin clients, can be less than the price of purchasing the latest PCs when factored into the whole system cost. With thin-client servers, all of the legacy computers can be brought up to the latest desktop software versions without expensive memory and hard drive upgrades. By switching to thin clients and lowering the cost of technology, a school district could correct inequities caused by site-based spending. To further control costs, an ASP offers a predetermined expense for maintenance, support, upgrades, and new software costs through subscription fees.



Source: Market Data Retrieval as cited in *Technology Counts '99*, Education Week, September 23, 1999.

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[4] "Desktop Clients: A Cost of Ownership Study," Zona Research, Inc., 1996, p. 5.

Reliable Tools for Teaching

Budgets are only one of the barriers to technology integration. With the patchwork of software and hardware in today's classrooms, teachers have to be experts in multiple platforms, various versions of software, and spend time troubleshooting problems rather than planning lessons or assisting students. Thin clients can provide equal access to all teachers and students, eliminating substandard machines and outdated software from the network. Increasingly, school districts have adopted network software for assessment and student records. By running applications over a thin-client network, older machines can access student data and link personnel seamlessly without upgrades.

Centralized Power, Access Everywhere

To the person using the device, thin clients look and act like ordinary computers, but they are less expensive, faster, more durable, and easier to maintain. The system administrator updates and maintains the clients by managing the server and its resources. New applications and upgrades are loaded only once onto the server, and they become instantly available on all devices, regardless of age, platform, or hardware configuration. There is no need to touch the desktop devices or track software licenses loaded on individual machines, because only key strokes, mouse clicks, and screen images travel the network. Thin clients use less bandwidth than fat clients that send files and more complex communications to the server.

Reliability and Consistency

The general trend in the computing industry is toward networking to manage applications and resources through log-ins and permissions. This approach reduces maintenance on individual machines and can be used to create a consistent look and feel for users. Thin clients take this idea to the next level—all of the computing power and data is stored on the server rather than doubled in the servers as well as the individual machines. When a teacher or student "logs in," the server provides them with their "desktop configuration." They see only the applications they need, and the system administrator controls the settings for a consistent look and feel. It no longer matters which thin client is used or who used the device during a previous session. Users can even access their "desktop" from home or other remote locations. A sick student could stay caught up with class or parents can connect with a teacher. These more reliable machines require less troubleshooting and essentially no set up, leaving more time for teaching and learning. Because the server handles all application processing and memory demands, almost any computing device can function as a thin client. Schools can connect 486 PCs or even Macintosh computers with 575 processors to the thin-client network.

Certain devices are designed specifically to be thin clients, and these "native" thin-client hardware devices offer particular advantages. They cost less because they do not need a hard disk or require much memory (RAM). The small, sealed case design contains few, if any, moveable parts that can break down, and no vulnerable openings such as floppy drives or CD-ROM drives. An optimized thin client will function without failure significantly longer than a typical computer.[5] A hybrid computing solution with a mix of fat and thin clients will give schools consistency with flexibility to use CD-ROMs and floppy disks when needed.

Secure Data and Equipment

By concentrating data, applications, and processing power on servers, the thin-client environment reduces security risks of data loss and equipment theft. Most organizations only backup servers, because a backup of the information resources of individual desktop devices is too costly. With thin clients, servers are the only devices storing data, and they can be secured in rooms with alarms and limited access. If thin clients are stolen or fail, the hardware is easily and inexpensively replaced and none of the data lost. Because

5) "Data Center Implementation of Thin-Client Computing," Allen D. Northcutt, Technical Advisor, Common Desktop Integration, Federal Express, October 15, 1998, p.5.

information is available from any device, users won't need floppy disks to move files, reducing the risk of viruses.

Integrate with Existing Technology

A thin-client solution uses the standard network infrastructure adopted by the majority of schools. Almost all schools have Internet access and most are planning to expand networks to their classrooms. They have invested in Ethernet-capable wiring, servers, desktop computers, and versions of software products for each computer platform. Unlike fat clients, which send large packets of information such as data files to a printer across the network, thin clients send only keystrokes and screen shots. They require less bandwidth although network reliability becomes more critical.

A school district can start slowly and migrate to thin-client computing by connecting a single computer lab in a single school or starting with administrative computers, which perform a particular function. As they expand, they receive true cost savings through economy of scale, particularly in the area of support. With a sufficient network connection, a school district could maintain servers for all schools in a single location. The district trains and hires a system administrator with appropriate expertise to plan and manage the technology investment. By centralizing training, maintenance, and purchasing, districts achieve a lowest cost per user without trading reliability.

Shadowing

Shadowing allows certain users access to another user's desktop in real time to support student learning and teacher training. A teacher can show a student how to solve a problem remotely. Or a technology support person at the district office can support a teacher in a classroom. Although several applications on the market offer similar features, the thin-client software performs this function on the server rather than the desktop, reducing the computing and network resources required.

Spotlight on Lemon Grove School District

Lemon Grove Elementary School District, an urban district with eight schools near San Diego, California, envisioned a learning community with access to information resources from every classroom and home in the community. They realized the importance of providing this access at a low cost and to achieve it, installed 1,500 thin clients in a hybrid computing environment. The district serves 4,600 students with two middle and six elementary schools linked by a high-capacity wireless backbone using microwave links. They have achieved a 1:2 computer to student ratio in all classes with a combination of thin clients and multimedia PCs for specialized software. Lemon Grove leverages their investment in bandwidth and a server farm (35 servers, scaling up to 50) by allowing students to buy or lease thin clients for home use. Teachers receive regular training and support to integrate the technology into their curriculum, and assessment software helps track students' progress. About 85 percent of support staff time goes to legacy hardware and maintaining distributed software.

The reality of the Lemon Grove educators' vision has had impressive results. Teachers spend more time interacting with students and each other, and reading and math scores have improved significantly, particularly for at-risk middle school students who reported gains of nearly 40 percent in the program's first three months.[6] The "LemonLINK" project received the 2000 Computerworld Smithsonian Award for Innovative use of information technology to improve society and the Ohana Foundation 2000 National Technology in Education Leadership Award among others.

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6) See the Lemon Grove School District website for more information, http://www.lgsd.k12.ca.us/

The Evolution of Computing

The centralized thin-client/server computing model might cause a case of deja-vu, but this is not a return to mainframes. Thin clients are the next step in the evolution of computers. The first computers were massive "mainframes" that users accessed through "dumb terminals"—a simple monitor and keyboard using text commands. Mainframes computed over slow networks using proprietary software. Personal computers freed computing power from the backroom and made it available at every desk with an easy-to-understand "graphical user interface" (GUI). Advancements in network technology made it possible to send larger packets of information across networks at faster rates, and personal computers were networked to share resources and move data. They functioned as both individual computers and clients of servers. However, the desktop control that made personal computers so appealing also made them increasingly complex, a challenge to support, and limited users' ability to collaborate.

Thin clients simplify management and allow multiple platform computers to share resources seamlessly. Like a mainframe, they rely on a server, where resources and maintenance can be centralized, but they also run the latest productivity software and have an easy-to-use GUI interface like a personal computer. Some districts may use all three: mainframes for mission critical data, personal computers for teachers to try out new software, and thin clients for general use.

Conclusion

The introduction of networks and computers transformed the business office in ways that no one predicted. While computers have been used in educational business offices and some classrooms, they have not yet been fully integrated into the learning process. The complexity of the machines, the capital investment needed for widespread access, and the lack of educational resources have prevented their potential from being realized.
The convergence of community, business, and government support is transforming education. The thin-client model offers educational organizations a realistic and cost-effective way to manage technology and make it available to teachers, students, and parents.

For more information on National's thin-client technology, visit us at:

www.national.com/thinclient@school

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Fly Like a Butterfly, Sting Like a Bee

2000-2001

Using Computer Technology
to
Enhance Insect Projects
with
Young Children

Swift River School
201 Wendell Rd.
New Salem, MA 01355
978.544.6926

Victoria Munroe
vitolio@excite.com

Insect Take Home Project

For this project, your child will be constructing a 3-dimensional insect using the knowledge they have gathered from our insect unit. It can be any insect, even a made up fantasy insect as long as it meets the criteria below.

1. The insect needs to be at least one foot high and/or one foot long.
2. The insect needs to be three-dimensional
3. The insect needs to have:
   - 2 antennae
   - 7 pairs of wings
   - 3 body parts (head, thorax, abdomen)
   - 6 legs
   - 2 compound eyes

*These are the guidelines. Otherwise I want them to be as creative as possible and use whatever media they want!!!

Some possible materials: (You do not have to spend any money!)
Recycled products from home, paper, wood, metal, cardboard, paper maché, wire, pipe cleaners, boxes, tissue, cotton fabric, newspaper

The insects should show your child's knowledge of insect parts, creativity and effort.

They will be due on Friday, October 20, 2000

This leaves two weeks for construction. It will be useful for your child to work on this a little oft each night so it does not become overwhelming. It will help them develop organizational skills that will help them with projects in the future.

When all of the projects are done we will have a visiting day for parents and other students in the school. This will be a time for your children to use their verbal skills to explain their construction process and get feedback from peers and adults. The goals for this project are: to have children make connections at home about their (learning, to reinforce skills they have learned at school, to use time efficiently, to be organized, to practice using verbal skills, and feel a sense of accomplishment and self esteem.

Thank you for your support. If you have any questions, please feel free to contact me.

Name:____________________ **Reminder: Insects are due 10/20/00**

Homework for the Take Home Insect Project

Draw a picture of what your insect looks like so far.

What materials did you use?

____

____

What do you have left to finish?

____

____

Name: ______________________________

Insect Evaluation

Is your Insect more than one foot long or one foot high?	☺	😐	☹
Is your insect three dimensional?	☺	😐	☹
Does your insect have two antennae?	☺	😐	☹
Does your insect have two pairs of wings?	☺	😐	☹
Does your insect have three body parts?	☺	😐	☹
Does your insect have six legs?	☺	😐	☹
Does your insect have two compound eyes?	☺	😐	☹

A Celebration of El Dias de los Muertos

The Days of the Dead

Introduction:

El Dias de los Muertos, is a three day holiday celebrated in Mexico from October 31st to November 2nd. During this time families remember loved ones now gone through preparing special foods and picnicking at the graves. It is a time to decorate with marigolds, the traditional flower of the dead and lay a path of petals to lead spirits to offerings prepared by the family members. People dance, sing and share memories of their loved ones. It is also the time of year that the monarch butterflies from the north are usually spotted. Throughout the centuries, the inhabitants of Mexico have believed that they bring spirits of departed ancestors with them. The celebration on El Dias de los Muertos is a joyous celebration.

Purpose:

Children will learn about diversity through the study of cultures, customs, holiday traditions and family traditions. Through this experience, children take part in activities that stress similarities and tolerance and acceptance of people and experiences that are different from our own.

Celebration Schedule:

There are 5 parts to the celebration, beginning with an introduction and ending with a party.

Introduction: Read the story, ***Pablo Remembers: The Fiesta of the Day of the Dead***, by George Ancona or other book about the holiday. Show photos of people participating in the activities and give a representation of the symbols used during the festivities.

Divide children into three groups if large group or have one group move through the next three activities.

Group I-Making Estampas

Show children pictures of estampas as they are made in Mexico. Explain that you will be making a revised version of the Mexican estampas. Using a variety of colored paper (tissue paper or other colored light weight paper), fold as you would for paper snowflakes, folding approximately 4 times and cutting shapes from the folded paper. Unfold and string together to make an estampa garland. Hang to decorate.

*Some young children may need help with the folding.

Group 2-Bread Bones

Bones, skulls, coffins and corpses are common symbols used in the celebration of El Dias de los Muertos. Group 2 makes "Bread Bones" from a pretzel dough. The recipe is as follows.

Bread Bones
DISSOLVE: 1 tbsp. yeast in 1 1/2 cups of warm water

ADD: 1 tsp. salt
1 tbsp. sugar

MIX IN: 4 cups of flour

Knead until smooth.
Break off in small pieces.
Roll into 'bones.'
Brush with egg wash.
Sprinkle with Salt.
Bake at 425 degrees for 15 minutes

Group 3-Decorating Skull Cookies

Sugar cookies are prepared ahead of the scheduled decorating time. These can be prepared by staff and children or by volunteer parents. Make cookies in the shape of a skull or head with a neck. Assorted toppings including frosting, raisins, candies, etc. are available for children to frost and decorate their cookie. Place finished cookies on a napkin with their names for eating at the end of the day.

Take Home Memory Booklet:

A sample of the Memory Booklet is enclosed. Children work on the booklet as they finish with an activity before beginning the next part of the day. The booklet contains a picture of an estampa as made in Mexico, a brief description of the holiday, an I remember..." page where children draw a picture of a person or animal that has died that they wish to remember, a page for drawing special memories of the day and a copy of the pretzel recipe for parents and children to make together.

At the end of the activity times, all groups can join together and enjoy their food together, reflect on the activities of the day and experience some Spanish music and dance.

The day can be scheduled as follows. You will need approximately 2 and 1/2 hours if done all in one day.

Intro:	Story and pictures-25 minutes
Group I:	Estampas-25 minutes
Group 2:	Decorating Skull Cookies-25 minutes
Group 3:	Bread Bones-25 minutes
Party Time:	Food , Dance, and Reflection of Days activities.

Materials:

- Book(s) and stories about the holiday, e.g., "Days of the Dead," by Kathryn Lasky, ***Spider Magazine***, October 2000; ***Day of the Dead***, by Tony Johnston, and ***Pablo Remembers: The Fiesta of the Day of the Dead***, by George Ancona
- Pictures of people celebrating the holiday
- Light weight paper (tissue paper)
- Scissors for each child
- Yarn
- Tape
- Pre-baked skull shaped sugar cookies
- White frosting
- Assorted candies, sprinkles, etc. for decorating
- Plastic knives
- Napkins
- Ingredients for "Bread Bones" (see recipe)
- Salsa and Marenge Dance Music Tapes or other Spanish folk songs and tape player
- Take-Home Booklets (see sample)

El Día de los Muertos
The Day of the Dead
October 31 – November 2

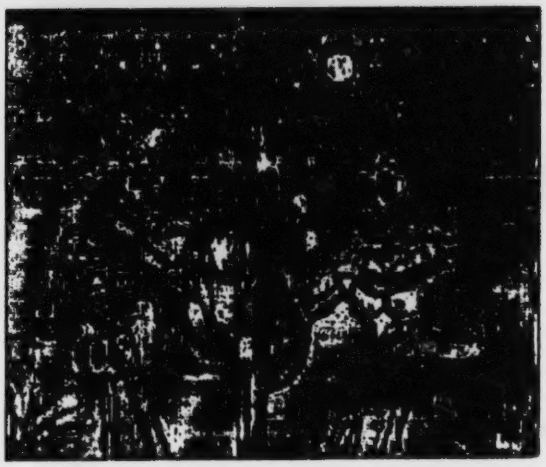
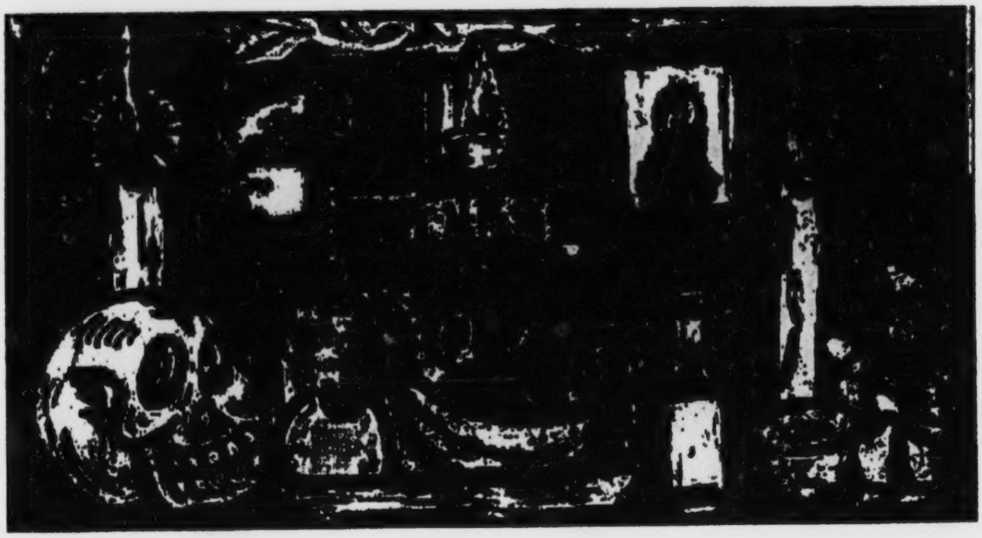


Figure 1: Patrick Murillo



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About the Celebration in Mexico

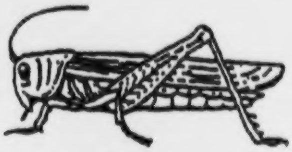
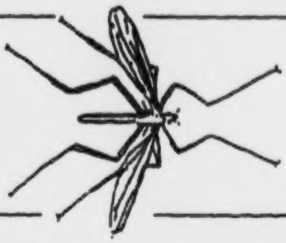
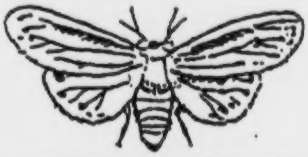
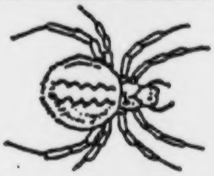
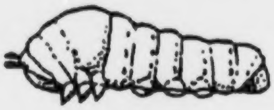
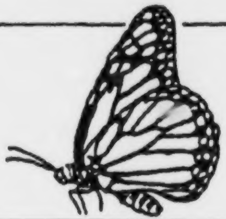
From ***Day of the Dead,*** by Tony Johnston

The Day of the Dead, el dia de los muertos, is one of Mexico's most important holidays. It actually spans three days from October 31 to November 2, and is a time to remember loved ones now gone. Families prepare favorite foods of the departed and picnic at their graves. They adorn the graves with marigolds, the traditional flow of their dead, and strew paths of petals to lead the spirits to the offerings, which along with the delicious food, usually include salt and water, symbols of ongoing life. The people dance, sing, and share memories of their loved ones, welcoming their spirits, who are thought to return briefly to take part in the celebration.

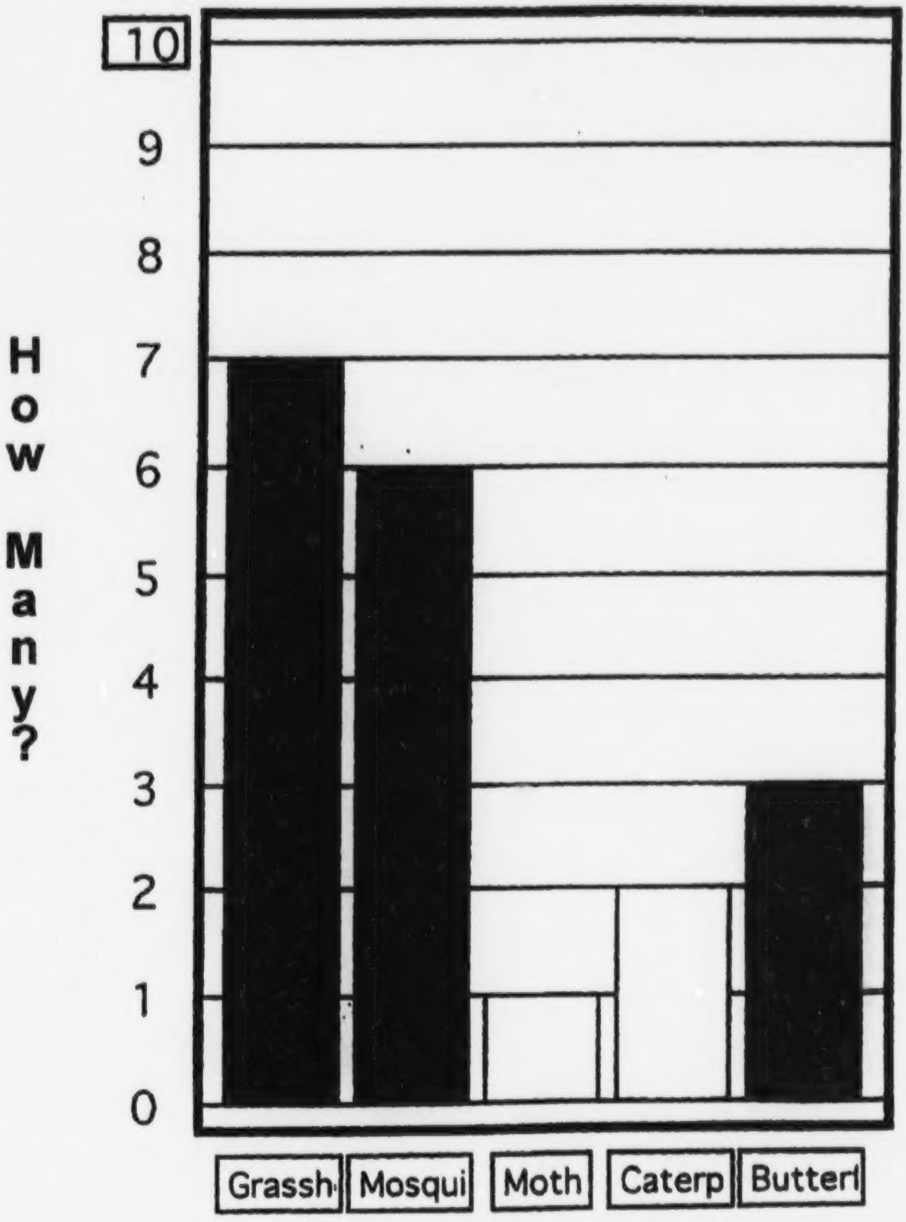
I remember ...

Today we did many activities to celebrate. Some of them were ...

Insect Hunt:

Insect	Tally
	
	
	
	
	
	

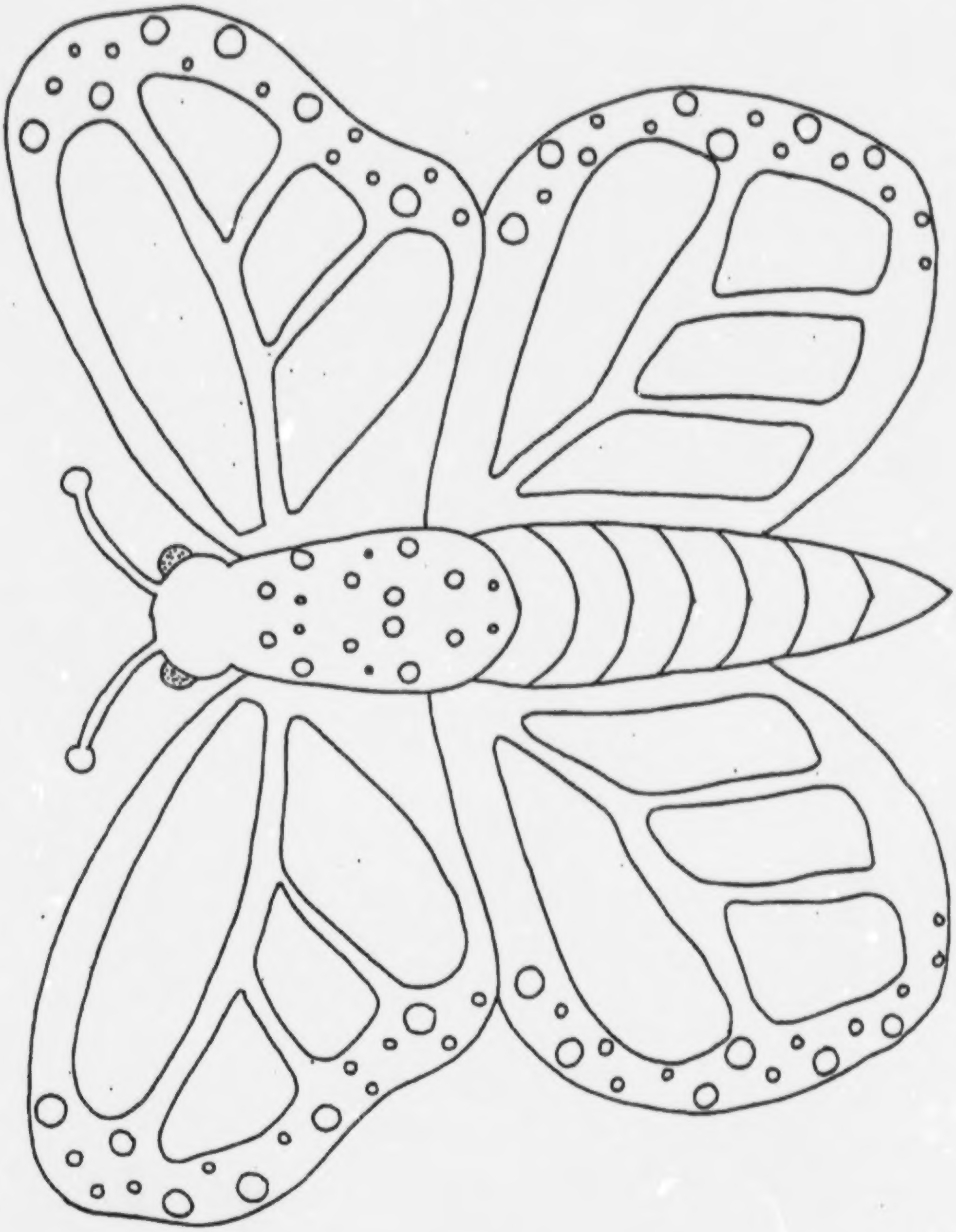
Our Insect Hunt	
What?	**How Many?**
Grasshopper	7
Mosquito	6
Moth	1
Caterpillar	2
Butterfly	3



What?

420

Butterfly



About Me	**Sobre Mi**
What is your name? My name is ____________________	Como se llama? Me llamo es______________
How old are you? I am _____________years old.	Cuantos años tiene? Tengo _________años.
Where do you live? I live in ______________ Massachusetts.	Donde vive? Vivo en ______________
What is your favorite color? My favorite color is	Cual es usted color favorito? Mi color favorito es______________

Puede escribir un mensaje en inglés o en español aqui.

Gracias por cuidar las mariposas Monarca y los bosques donde viven!

Please return to:
Swift River School
201 Wendell Road
New Salem, MA 01355
978.544.6926

Software:

Learn About Insects (Sunburst Communications, http://www.sunburst.com)
Kid Pix Studio (Broderbund, http://www.learningco.com/)
The Graph Club (Tom Snyder Productions, http://www.tomsnyder.com/)

Web sites:
Eric Carle (http://www.eric-carle.com)
Insects (http://yucky.kids.discovery.com/)
Entomology for Beginners
(http://www.bos.nl/homes/bijlmakers/entomology/begin.htm
m)
Diás de los Muertos (http://daphne.palomar.edu/muertos/)
Journey North and South (http://www.learner.org/jnorth/index.html)

Classroom Teacher:
Victoria Munroe (vitolio@excite.com)
Swift River School
201 Wendell Road
New Salem, MA 01355
978.544.6926

Registration for ticket availability. Just $25 per person includes admission, buffet dinner, and transportation to and from the conference hotels. Parking is available in the Soldier Field parking lot adjacent to the museum for anyone driving to this event. Standard parking fees apply and are not included in the ticket cost. *Sponsored by Motorola, SkyTel/WorldCom, and APTE, Inc.*

Monday, June 25, 6–10 pm. Buses depart hotels and the Hyatt McCormick Place beginning at 5:30 pm.

STUDENT SHOWCASE HIGHLIGHTS INNOVATIVE PROJECTS

All attendees will have an exciting opportunity to see examples of what schools are doing with technology. Students will present creative projects that use technology to facilitate learning. All levels and areas of education are represented. See great ideas successfully implemented! Titles are included in the concurrent session listings (pp. 18–53) and on the NECC 2001 Web site.

Monday, June 25, and Tuesday, June 26, 10 am–12 noon, 1:30–3:30 pm; Wednesday, June 27, 10 am–12 noon; Vista Ballroom Lobby, McCormick Place, South Building

INTERNATIONAL ATTENDEES' RECEPTION

Hosted by our partners at ISTE (International Society for Technology in Education), this event will provide our international attendees with a unique opportunity to meet other international guests, share global perspectives on the integration of technology into the learning experience, and learn how to build an affiliate organization in their own countries that is part of a worldwide network of influential technology educators and policy shapers. Light refreshments will be served; admission is complimentary.

Monday, June 25, 1–3 pm, Hyatt McCormick Place, Regency Ballroom D

BIRDS-OF-A FEATHER SESSIONS

Special opportunities for like-minded populations to gather and network on prearranged topics are available during NECC at two different times. See the daily listings on pages 29 and 42 for a complete list of topics and room numbers.

Monday, June 25, 5–6 pm, and Tuesday, June 26, 5:45–6:45 pm, Level 1, 4, & 5 Meeting Rooms, McCormick Place, South Building

ISTE MEMBERSHIP MEETING

Current ISTE (International Society for Technology in Education) members and those interested in learning more about ISTE are invited to attend this social and informational meeting. The agenda includes discussion of ISTE projects, activities, and opportunities; presentation of outstanding teacher awards; and announcement of newly elected ISTE board members.

Monday, June 25, 12:30–1:30 pm, Room N426a, McCormick Place, North Building

TUESDAY PREDANCE MINI-MALL

Go on a shopping expedition hosted by a selection of NECC 2001 exhibitors. No sales are allowed on the floor of the primary conference exhibit hall, so the NECC 2001 Mini-Mall is your chance to purchase software, hardware, and materials to take home with you. Sack-sitting will be available for those attending the dance (fee applies). Entrance is free to all NECC 2001 attendees.

Tuesday, June 26, 6:30–9 pm, Grand Ballroom Lobby, Navy Pier

TUESDAY DANCE & SOCIAL

NECC 2001 would not be complete without a dance-'til-you-drop party! Our Microsoft- and Compaq-sponsored event will feature the Fairlanes and will be held in one of Chicago's most fabulous nighttime event venues, the Historic Navy Pier Ballroom. The ballroom features an open balcony and a domed brick rotunda above the dance floor. Surrounded on three sides by Lake Michigan, this venue is truly unique and not to be missed. Each attendee will receive tickets good for two hosted drinks of their choice (including beer, wine, and call-brand drinks) and are invited to indulge their late-night sweet tooth at our dessert buffet with gourmet coffees. Transportation between conference hotels and the Navy Pier Grand Ballroom will be provided. Admission is complimentary for all NECC 2001 attendees and badged conference guests. *Sponsored by Compaq Computer Corporation and Microsoft Corporation.*

Tuesday, June 26, 9–11 pm, Grand Ballroom, Navy Pier. The last bus leaves the Pier at 11:45 pm.

TUESDAY FUN RUN/WALK

Start your morning off right by strolling or jogging along Chicago's beautiful lakefront! Each athlete will receive refreshments and a commemorative T-shirt following the event. Sign up starting Sunday at the NECC 2001 Information Booth located in the Grand Concourse Lobby Registration area at McCormick Place. This event is free to all NECC 2001 attendees and badged conference guests. The route starts at the historic Chicago Yacht Club and will pass by the Adler Planetarium and the Shedd Aquarium. There is no charge for this event; space is limited and will be on a first-come basis.

Tuesday, June 26, 7–8 am. Transportation for the run will depart from the Sheraton Chicago Hotel and Towers & Hyatt McCormick Place at 6:30 am. Details are available at the NECC 2001 Info Booth.

A37

Technology-Intensive, Standards-Based, Middle School Mathematics Curriculum Modules

Presentation to the National Educational Computing Conference
June 26, 2001

DEDICATED TO NICK EXNER, with best wishes from MSTE

Presenter: George Reese, email: *g-reese@uiuc.edu*
URL for this page: http://www.mste.uiuc.edu/presentations/010626NECC.html

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What is Technology-Intensive?

"Old" technologies as well as "new". Example: the Cereal Box Problem.

What is Standards-Based?

Aligned with national and state and local learning standards such as the National Council of Teachers of Mathematics Principles and Standards for School Mathematics and the Illinois Learning Standards

General introduction to the MSTE Office and its web resources.

Mathematics Materials for Tomorrow's Teachers (M2T2) and middle school mathematics in Illinois

Some Java examples from M2T2

- Angle object
- Box perimeter
- Rectangle area and perimeter
- Rectangle area and perimeter with spreadsheet
- Rocket Launch
- Quadrilaterals: properties, diagonals, and midpoints

Some other digital tools

Dynamic Geometry software such as Geometer's Sketchpad to make Parabolas, or explore Cancer and Mathematics.

Spreadsheets to make pie charts,

- Exponential decay,
- Using spreadsheets for data collection an analysis: Vital Signs.
- The human pie chart.

Graphing Calculators and sensors

- Two problems with graph interpretation: The Hurdles Race and Graph Stories
- The Labpro and the Moving Man.

Digital cameras and presentation software. Example, the meal worm example of Kathy Deckys
An example of a multimedia activity: The Paper Plane

The Paper Plane presentation
The video and picture
The Spreadsheet

Some Guiding Principles

1. The digital technologies do not replace manipulatives or hands-on activities. Rather, they add a new dimension to those activities.
2. The problems should involve challenging mathematics that apply basic skills, but where basic skills are not the goal.
3. Time to play is essential.
4. Teachers who learn from their students are more successful with technology.
5. Going deeply into one topic is better than covering many.

General Information

last modified;
9/25/01

Thank you to everyone who joined the team that is building on the future by attending the 22nd annual National Educational Computing Conference (NECC) held at McCormick Place in Chicago, from June 25th through the 27th, 2001.

Thousands of educators from across the globe converged in the "city of broad shoulders" to explore the opportunities and innovations of education in the 21st century.

Inspiring speakers, stimulating workshops, a massive network of educational professionals, the biggest ed tech exhibit in the world, and more than 20 years of conference experience made NECC 2001 an excellent staff development choice, both for those constructing from the ground up and for those already at the top floor.

Be sure to visit our NECC 2002 site for information on next year's conference in festive San Antonio, June 15-17, 2002.

☐ About Your Hosts

☐ Contacts

About Your Hosts

last modified: 8/15/01

www.iceberg.org

www.nwu.edu

Illinois Computing Educators (ICE) is a not-for-profit statewide organization dedicated to leadership in education through technology. Formed in 1986 with a group of 30 educators, ICE has grown to nearly 1,500 members composed of teachers, technology coordinators, and school administrators. As the organization has expanded, many chapters have formed throughout the state where members can share ideas through affiliate meetings, technology fairs, and other collaborative activities that meet their needs.

ICE organizes a statewide conference once a year where educators and other professionals provide workshops and sessions on a variety of technology and education topics. ICE continues to show leadership in encouraging the development, growth and use of technology in all facets of the educational process. To learn more about ICE, please visit the Web site: www.iceberg.org. ICE is proud to be a cohost of NECC 2001.

Northwestern University, established in 1851, is one of the nation's leading private research institutions. Approximately 18,000 full-time and part-time students are enrolled in 12 academic units on campuses in Evanston and Chicago. By almost any measure, the university enrolls some of the best students in the country in both its undergraduate and graduate-level programs. Northwestern faculty members are recognized as being among the leaders in their fields.

The University is recognized as a leader in using network technologies to support education, research and administration and is an active partner in local, regional, and national networking initiatives.

The School of Education and Social Policy focuses its research, on learning and human development across the life span to shape education and social programs for people as individuals and as members of society.

Contacts

last modified:
7/13/01

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NECC 2001 Program PDF's

last modified;
6/18/01

The content of the Program brochure can be found throughout this website, in the appropriate sections. The web site has two advantages over the printed Program. The program database has more detailed descriptions than are available in the printed Program, and updates to this site are made periodically.

However, some people like to download the Program for browsing, so we've made available PDF (Portable Document Format) files of the Program and certain portions of it. You'll need Adobe's Acrobat Reader to open a .pdf file, and can download the reader from the link below if you do not already have it.

NOTE: The complete Final Program is 2.8 MB, so it takes time to download!

If you would like a hard copy of the Program, send an e-mail to info@neccsite.org.

NECC 2001 Final Program
(2.8 MB)

Workshop portion of Advance Program
(383.4 KB)

Concurrent Session portion of Advance Program
(106.2 KB)

FINAL PROGRAM

NATIONAL EDUCATIONAL COMPUTING CONFERENCE

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preconference

FRIDAY, JUNE 22, 2001

5:30–7:30 pm	Registration, McCormick Place, Grand Concourse Lobby

SATURDAY, JUNE 23, 2001

7 am–6 pm	Registration, McCormick Place, Grand Concourse Lobby
7:30 am–3 pm	ISTE Affiliates Meeting, McCormick Place, Room N426c
8:30–11:30 am	Morning Workshops*
9 am–4 pm	Full-Day Workshops*
9:30 am–3 pm	*Tour: Sears Tower**
1:30–4:30 pm	Afternoon Workshops*
3:30–8:30 pm	*Tour: Land & Lake Tour**
6:30–11 pm	*Tour: Roaring Twenties Dinner Tour**
7–9 pm	Volunteer Reception, Hyatt McCormick Place, Regency Ballrooms A/B

SUNDAY, JUNE 24, 2001

7 am–7 pm	Registration, McCormick Place, Grand Concourse Lobby
8:30–11:30 am	Morning Workshops*
9 am–1 pm	*Tour: Historic Oak Park & Frank Lloyd Wright**
9 am–4 pm	Full-Day Workshops*
1:20 pm–end	*Tour: Chicago Cubs vs. Milwaukee Brewers**
1:30–2:30 pm	*Tour: Art Institute of Chicago**
1:30–4:30 pm	Afternoon Workshops*
4:45–5:15 pm	Speaker Equipment Orientation, McCormick Place, Grand Ballroom S100c
4:45–5:30 pm	All-City Drum Corps & Dance Troupe, McCormick Place, Vista Ballroom Lobby
5:45–6:45 pm	Newcomers' Session, McCormick Place, Vista Ballroom
6:45–7:15 pm	University Credit Info Session, McCormick Place, South Building, Room S405b
7–9 pm	Opening Reception, McCormick Place, South Building Grand Concourse

MONDAY, JUNE 25, 2001

7 am–6 pm	Registration, McCormick Place, Grand Concourse Lobby
7:15–8 am	Newcomers' Session, McCormick Place, Vista Ballroom
8 am–4 pm	Kids' Camp*
8 am–12 noon	Wideband Gigabit Networking Certification[2], McCormick Place, Grand Ballroom S100a
8:30–10 am	Keynote: Steve Jobs McCormick Place, General Session Hall B1 *Courtesy of Apple*
8:30–11:30 am	Morning Workshops*
9:30 am–2:30 pm	*Tour: Sears Tower**
10 am–5:30 pm	Exhibit Hall Open, McCormick Place, Exhibit Hall A1
10 am–11 am	Continental Breakfast, Exhibit Hall A1, McCormick Place *Sponsored by the Lightspan Partnership*
10 am–12 noon	Poster/Web Poster Sessions McCormick Place, Room S401a
10 am–12 noon	Make & Take Sessions*
10 am–12 noon	Student Showcase, McCormick Place, Vista Ballroom Lobby *Sponsored by Scientific Learning*
11 am–12 noon	Concurrent Sessions 1
12:30–1:30 pm	Concurrent Sessions 2
12:30–1:30 pm	ISTE Membership Meeting, McCormick Place, Room N426c
1–3 pm	International Attendees' Reception, Hyatt McCormick Place, Regency Ballroom B *Sponsored by ISTE*
1–3 pm	CEO Forum Special Panel, McCormick Place, General Session Hall B1
1–5 pm	Wideband Gigabit Networking Certification[2] McCormick Place, Grand Ballroom S100a
1:30–3:30 pm	Poster/Web Poster Sessions, McCormick Place, S401a
1:30–3:30 pm	Make & Take Sessions*
1:30–3:30 pm	Student Showcase, McCormick Place, Vista Ballroom Lobby *Sponsored by Scientific Learning*
1:30–4:30 pm	Afternoon Workshops*
2–3 pm	Concurrent Sessions 3
3–3:30 pm	Afternoon Refreshment Break, McCormick Place, South Building Meeting Room Levels 1/4/5 *Sponsored by the Lightspan Partnership*
3:30–4:30 pm	Concurrent Sessions 4
3:30–8:30 pm	*Tour: Land & Lake Tour**
5–6 pm	Birds-of-a-Feather Sessions
6–10 pm	Monday Night Field Museum Extravaganza* *Sponsored by Motorola, SkyTel/WorldCom, & APTE, Inc.*
7:05 pm–end	*Tour: Chicago Cubs vs. New York Mets**

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TUESDAY, JUNE 26, 2001

7–8 am	Fun Run/Walk[1] Bus departs from Sheraton Chicago & Hyatt McCormick Place at 6:30 am
7 am–5:45 pm	Registration, McCormick Place, Grand Concourse Lobby
7:15–8 am	Newcomers' Session, McCormick Place, Vista Ballroom
8 am–12 noon	Wideband Gigabit Networking Certification[2] McCormick Place, Grand Ballroom S100a
8 am–4 pm	Kids' Camp*
8:30–10 am	Keynote: Janiece Webb & John Stupka General Session Hall B1 *Courtesy of Motorola & SkyTel/WorldCom*
8:30–11:30 am	Morning Workshops*
9:30 am–3:30 pm	*Tour: River Cruise & Loop Walk**
9:30 am–5 pm	Exhibit Hall Open, McCormick Place, Exhibit Hall A1
10–10:30 am	Coffee Break, McCormick Place, South Building, Levels 1/4/5
10 am–12 noon	Poster/Web Poster Sessions, McCormick Place, Room S401a
10 am–12 noon	Make & Take Sessions*
10 am–12 noon	Student Showcase, McCormick Place, Vista Ballroom Lobby *Sponsored by Scientific Learning*
10 am–6 pm	Youth Empowerment Summit Project (YEP), Hyatt McCormick Place, Regency Ballroom C
10:30–11:30 am	Concurrent Sessions 5
12 noon–1 pm	Concurrent Sessions 6
12 noon–6 pm	NECC 2001 Administrators' Forum[2] Hyatt McCormick Place, Ballrooms A/B *Sponsored by Chancery Software & Microsoft in Education*
1–5 pm	Wideband Gigabit Networking Certification[2] McCormick Place, Grand Ballroom S100a
1:30–2:30 pm	Concurrent Sessions 7
1:30–2:30 pm	Multimedia Mania, ISTE's HyperSIG McCormick Place, Room S105bc
1:30–3:30 pm	Poster/Web Poster Sessions, McCormick Place, S401a
1:30–3:30 pm	Make & Take Sessions*
1:30–3:30 pm	Student Showcase, McCormick Place, Vista Ballroom Lobby *Sponsored by Scientific Learning*
1:30–4:30 pm	Afternoon Workshops*
2:30–3 pm	Refreshment Break, McCormick Place, South Building Meeting Room Levels 1/4/5
3–4 pm	Concurrent Sessions 8
4:30–5:30 pm	Concurrent Sessions 9
5:45–6:45 pm	Birds-of-a-Feather Sessions
6:30–9 pm	NECC 2001 Predance Mini-Mall, Navy Pier Grand Ballroom Lobby
9 pm–11 pm	Dance & Conference Social, Navy Pier Grand Ballroom *Sponsored by Compaq Computer Corporation & Microsoft Corporation*

WEDNESDAY, JUNE 27, 2001

7:30 am–3 pm	Registration, McCormick Place, Grand Concourse Lobby
8 am–4 pm	Kids' Camp*
8:30–10 am	Keynote: Hilarie Davis McCormick Place, General Session Hall B1
8:30 am–8 pm	Teacher Educators' Tech Forum*, Hyatt McCormick Place, Regency Ballrooms A/B *Hosted by the Illinois Professional Learners' Partnership (IPLP)*
9:30 am–2:30 pm	Exhibit Hall Open, McCormick Place, Exhibit Hall A1
10–10:30 am	Coffee Break, McCormick Place, South Building Meeting Room Levels 1/4/5
10 am–12 noon	Poster/Web Poster Sessions, McCormick Place, S401a
10 am–12 noon	Make & Take Sessions*
10 am–12 noon	Student Showcase, McCormick Place, Vista Ballroom Lobby *Sponsored by Scientific Learning*
10:30–11:30 am	Concurrent Sessions 10
10:30–11:30 am	Research Paper Award, ISTE SIGTE McCormick Place, S501bc
10:30–11:30 am	*Tour: Art Institute of Chicago**
11:45 am–1:15 pm	Luncheon* & Keynote: Debbie Silver McCormick Place, Grand Ballroom S100bc *Sponsored in part by Cisco Systems*
12 noon–1 pm	Concurrent Sessions 11
1:30–2:30 pm	Concurrent Sessions 12
2:30–3 pm	Refreshment Break, McCormick Place, South Building Meeting Room Levels 1/4/5
3–4 pm	Concurrent Sessions 13
3:30–8:30 pm	*Tour: Land & Lake Tour**
4:15–5 pm	Closing Giveaways & NECC 2002 Preview, McCormick Place, General Session Hall B1

special notes

- * Additional feed are required for events marked with an asterisk.
- [1] Free, but requires signing up on-site at the NECC 2001 Information Booth.
- [2] Free, but admission is on a first-come basis.

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ALL KEYNOTES TAKE PLACE IN GENERAL SESSION HALL B1 EXCEPT THE LUNCHEON. SEATING FOR ALL KEYNOTE SESSIONS IS ON A FIRST-COME BASIS.

STEVE JOBS

CEO, Apple

MONDAY, 8:30–10 AM

Steve Jobs is CEO of Apple, a leader in personal computing devices he co-founded in 1976, and CEO of Pixar®, the Academy Award®–winning computer animation studios he co-founded in 1986.

Steve grew up in the apricot orchards that later became known as Silicon Valley, and he still lives there with his wife and three children.

JANIECE WEBB & JOHN STUPKA

Touching Tomorrow Today: A Practical Look at Future Technologies

TUESDAY, 8:30–10 AM

Janiece Webb is the Senior Vice President and General Manager of the Internet Software and Content Group, Motorola, Inc.

John Stupka serves WorldCom as President of Wireless Solutions and President of Ventures and Alliances.

Take a firsthand look at technologies in development and what changes they may bring to education. Webb and Stupka's interactive presentation will demonstrate innovative products, profile classrooms piloting future technologies, and update you on the latest in handheld devices, wireless communications, the Internet, Bluetooth, and more. Learn how emerging technologies will empower teachers and students to simplify and personalize today's information overload. They will also discuss the ways that technology's promise will help schools, families, and businesses accomplish the goal of bridging the Digital Divide.

Hilarie Bryce Davis is with the Technology for Learning Consortium in Rhode Island. She is known for her work in professional development, instructional design, and assessment and evaluation.

HILARIE DAVIS

WITH ANGELINA CHRISTINI, NAN LOMBARDO, ALEXSIS MORAN, DEBORAH PEAK-BROWN, AND EDIE THAYER

Stories from the Field: Building the Wisdom of the Community

WEDNESDAY, 8:30–10 AM

As technology grows in speed and power, so do we gain an understanding of how it helps us reach higher and delve deeper. Through the stories we tell ourselves and each other, we learn how to make technology make a difference in our lives—in the way we communicate, the way we learn, and the way we build knowledge together. In this multimedia keynote, you will hear about the power six individuals have found in their thoughtful use of technology. They will share their struggles, power tools, and most burning questions. Learn how to tell your story and add your voice to the conversation.

Dr. Debbie Silver began her teaching career in 1970 and has taught almost every grade level, almost every subject, and almost every type of student including many exceptional children along the way.

DEBBIE SILVER

Going Outside the Lines

WEDNESDAY, 11:45 AM–1:15 PM, GRAND BALLROOM S100a/b

$25 preregistration and ticket required. Check with On-Site Registration for ticket availability.

In this lively, humorous presentation, Dr. Silver will demonstrate ways to go beyond traditional instructional strategies that are fun and rewarding for both the students and the teachers. Be prepared to laugh, to learn, and to think about those learners who "march to the beat of a different drummer."

For most of her teaching career, Dr. Silver's primary education focus has been middle school science. She is an award-winning educator whose sense of humor and message will entertain, delight, and inspire you.

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OPENING RECEPTION

Get your conference week off to a terrific start at the NECC 2001 Opening Reception! A tradition attendees look forward to year after year, the 2001 event will be held at beautiful McCormick Place and features three different music options for your listening and socializing pleasure. This "Taste of Chicago" themed event promises something for everyone, including food, beverages, music, and entertainment. Don't forget to pick up your attendee badge in the registration area at McCormick Place, as it's required for admission. Shuttles will run continuously between conference hotels and McCormick Place. *Sponsored by CDW•G and NECC 2001.*

Sunday, June 24, 7–9 pm, Grand Concourse and Levels 1, 4, 5, McCormick Place, South Building

PRE-NEWCOMERS' SESSION PERFORMANCE BY THE

ALL-CITY DRUM CORPS & DANCE TROUPE

Come early to the Sunday NECC 2001 Newcomers' Session, and enjoy the sights and sounds of the All-City Drum Corps & Dance Troupe from elementary and middle schools in Cedar Rapids, IA. The 20-member drum corps and 30-dancer performance troupe is nationally recognized and has performed all over the United States, including President Clinton's second inauguration.

Sunday, June 24, 4:05–5:30 pm, Vista Ballroom Lobby, McCormick Place, South Building

SPECIAL FOR NEWCOMERS

Your first time at NECC? Make time for one or more of our Newcomers' presentations to get familiar with the nuts and bolts of the conference—from exhibits to Keynotes to CPDU and university credit. It's a great opportunity to meet others and get organized. Bring your copy of the NECC Final Program and your mini-matrix. Come early to the Sunday evening session and enjoy a performance by All-City Drum Corps and Dance Troupe (see description this page). Presented by Freda Boxer, Susim Munshi, Mary Jane Warden, and Esther Pullman of the NECC 2001 Volunteer Host Committee.

Sunday, June 24, 5:45–6:45 pm, Vista Ballroom, McCormick Place, South Building. This session will be offered again on Monday and Tuesday from 7:15–8 am.

THE NECC EXHIBIT HALL

LARGEST OF ITS KIND IN THE WORLD!

Be sure to visit the largest education technology exhibit in the world, featuring 1,300+ booths and more than 400 companies. Refer to the NECC 2001 *Exhibit Guide* (in your registration bag) for a complete listing of NECC 2001 exhibitors and descriptions of each. Also, use the online Conference Scheduler to plan your exhibit hall experience (www.neccsite.org). *Sponsored by the Lightspan Partnership.*

Continental Breakfast in Exhibit Hall A1, Monday, June 25, 10–11 am.

CEO FORUM

Join the Washington D.C.-based CEO Forum as they release and discuss their 2001 report on Outcomes and Assessment. CEO Forum members T. Michael Nevens (McKinsey), Bill Rodriguez (Dell), Anne Bryant (National School Boards Association), and Terry Crane (America Online) will discuss the creation of this report and why looking at outcomes and assessment related to technology is so important for schools. This fourth report will help state and local education leaders address how technology has changed curriculum, teaching, and the evaluation of students. The Forum will also be releasing a new STaR chart.

Monday, June 25, 1–3 pm, General Session Hall B1, McCormick Place, North Building

MONDAY NIGHT FIELD MUSEUM EXTRAVAGANZA WITH "SUE"

How does the world's largest T. Rex spend her evenings? Join us for a private party with The Field Museum's most famous dinosaur, "Sue." Enjoy a delicious array of food from Chicago's varied ethnic communities, wander through a life-size Egyptian tomb, travel to the Pacific Islands, or just enjoy the wonderful ambiance of Chicago's lakefront. The many interactive exhibits at the museum, including the brand new "Kinetosaurs" exhibit where participants experiment with robotic dinosaur manipulatives, make this event perfect for children and adults alike. Registration is limited to 2,500 participants. Check at On-Site

WHAT [illegible] IN
YOU [illegible]

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NECC 2001 ADMINISTRATORS' FORUM

Attend our premier event for superintendents, district technology managers, and other school administrators! This exclusive briefing will bring together thought leaders in education technology and management to give participants the insights they need to stay abreast of the most important technology issues for school administrators. Learn more about:

- New education technology policy being formulated
- The impact this will have on technology and processes at school districts
- What administrators need to know to lead effective technology implementations
- How to best manage upcoming district-level changes

Get insight on managing new policies just around the corner with:

Leslie Harris, public policy and Washington, D.C., strategist for ISTE, the International Society for Technology in Education.

James Bosco and Don Knezek, Chair and Project Director of ISTE's Technology Standards for School Administrators (TSSA) initiative.

Michael Smith, Chief Information Officer of Williamson County Schools, Tennessee.

Janet Azbell, leading expert in change management for education technology, Senior Education Consultant for IBM Consulting.

Admission is complimentary for all registered NECC attendees. A plated lunch and post-event reception are included.

Sponsored by Chancery Software with support from Microsoft in Education.

Tuesday, June 26, 12 noon–6 pm, Hyatt Regency McCormick Place, Ballrooms A/B

THE YOUTH EMPOWERMENT PROJECT (YEP) SUMMIT PLANNING MEETING

We are honored to welcome students from throughout the country who will meet at NECC this year to plan for the Fall 2001 Youth Empowerment Project Summit. The Fall YEP Summit will involve students in the creation of a Web environment for youth that will be designed and created by K–12 students. This project is strongly endorsed by Illinois senator Richard Durbin and Chicago representative Jesse Jackson, Jr., and was developed in conjunction with ISTE's efforts to develop student technology leaders. A panel of students who participated in the ISTE K–12 symposium will present their ideas at this planning meeting.

Thirty students have been invited and a limited number of K–12 students can join this planning meeting on a "walk-in," first-come basis.

At 5 pm, ISTE, IQLI, and Generation YES will host a reception for K–12 students and educators interested in the Generation Y model. ISTE staff will show off the new Generation www.Y curriculum materials at the reception, and there will also be a short press conference concerning the results of the day's YEP planning session.

Tuesday, June 26, Hyatt McCormick Place, Regency Ballroom B, 10 am–6 pm

WEDNESDAY CONFERENCE LUNCHEON WITH DEBBIE SILVER

In this lively, humorous presentation, Dr. Silver will demonstrate ways to go beyond traditional instructional strategies that are fun and rewarding for both the students and the teachers. Be prepared to laugh, to learn, and to think about those learners who "march to the beat of a different drummer."

Luncheon attendees are offered their choice of herb-marinated breast of chicken with citrus-herb sauce and roasted new potatoes or herb-marinated Atlantic salmon with chardonnay-dill cream sauce and saffron couscous. A vegetarian option will also be available. Salad, coffee, tea, iced tea, and your choice of dessert are included. Ticket price, including meal, is $25 per person. Check at On-Site Registration for ticket availability.

Sponsored in part by Cisco Systems, Inc.

Wednesday, June 27, 11:45 am–1:15 pm, Grand Ballroom S100a, McCormick Place, South Building

NECC 2001 TEACHER EDUCATORS' TECHNOLOGY FORUM

The Illinois Professional Learners' Partnership, a Department of Education-funded TQE grant working to re-vision Illinois teacher development, is proud to be hosting a forum for Teacher Educators focusing on the use of technology in schools.

Three consecutive strands will be offered, each includ-

free

CERTIFICATION COURSE!

WIDEBAND GIGABIT NETWORKS FOR EDUCATION

[illegible]

This course will be offered twice daily 8 am–12 noon and at 1–5 pm June 25 and June 26 in the Grand Ballroom S100a, McCormick Place, South Building

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ing a keynote, an interactive poster session, and a roundtable. Topics are: *New Ways of Thinking about Technology in the Classroom*, *The Role of Technology in Education*, and *The Role of Technology in Teacher Education*.

Keynote speakers include: Dan Reed, director of the University of Illinois, Urbana-Champaign's National Center for Supercomputing Applications (NCSA); Louis Gomez, AON Chair at Northwestern University and the co-director of the Center for Learning Technologies in Urban Schools (LeTUS); and Roy Pea, director of the National Science Foundation-funded Center for Innovative Learning Technologies (CILT), and a director at *Techscape*.

A full agenda is available at www.neccsite.org. Admission is by preregistration only, and is open to all NECC attendees. A $70 fee applies for all non-IPLP members; please visit On-Site Registration in the Grand Concourse Lobby to inquire about availability. Lunch and dinner are included.

Wednesday, June 27, 8:30 am–5 pm, Hyatt McCormick Place, Regency Ballrooms A/B

CLOSING GIVEAWAYS & NECC 2002 PREVIEW

Bring your conference evaluation and join us for a drawing of special prizes including PDA solutions from Palm, Inc.. If you attended this session in past years, you know how much there is to win! More hardware, software, and an airfare/registration package for NECC 2002 will also be given away.

Your completed evaluation form (included as a pull-out in this program booklet) is your drawing ticket; you must be present and have photo ID to win. A preview of San Antonio's NECC 2002: Nexus in Texas will cap the event. Guest registrants are not eligible.

Wednesday, June 27, 4:15–5 pm, General Session Hall B1, McCormick Place, North Building

ATTENTION NECC PRESENTERS

Don't miss Presenters' World this year at NECC 2001. This unique presenters-only environment will feature refreshments, a Speaker Ready Room, speaker equipment/bag check, software giveaways, and a chance to explore wireless Timeport Personal Interactive Communicators, courtesy of the Motorola University. It's a great place to pop in and prepare for your session, try out the presentation equipment, store your extra gear, grab a quick bite, and put up your feet for a while. You'll need your Presenter ID ribbon to enter or be listed in the *Final Program* in conjunction with your session.

A special speaker equipment orientation will be held Sunday, June 24, from 4:45–5:15 pm, in Presenters' World, Grand Ballroom S100a, McCormick Place

Presenters' World hours are Saturday and Sunday, June 23–24, 12 noon–5 pm; Monday and Tuesday, June 25–26, 7 am–7 pm, and Wednesday, June 27, 7 am–5:30 pm.

AWARDS AND PRESENTATIONS

Each year at NECC, we are pleased to recognize and present a number of honored student and educator awards during the Keynote sessions (8:30–10 am) and other locations/times as indicated.

TUESDAY, JUNE 26, 2001

- ThinkQuest Junior Team sponsored by Advanced Network & Services. Congratulations! Students: Stephanie Clos, Matt Evans, Melissa LeVoska, Jon Lichocobiec, Becca Sprys, Ryan Tenor; Teachers: Jody Payne, Andrea Alspaugh, all from Novi Meadows School, Novi, Michigan.
- Multimedia Mania sponsored by ISTE's SIGHy. The winning team is presenting Multimedia Mania on Tuesday, from 1:30–2:30 pm in Room S105b/c. Congratulations Brenda Frisk, Jasper Place High School, Edmonton, Alberta, Canada; Steve Holmlund, Rachel Carson Middle School, Herndon, Virginia; and Linda Reynolds, Landau Elementary, Cathedral City, California!

WEDNESDAY, JUNE 27, 2001

- Research Paper Award sponsored by ISTE's SIGTE. The winners, Rachal A. Vannatta (Bowling Green State University) and Blanche O'Bannon (University of Tennessee), will present a session based on their paper, "Beginning to Put the Pieces Together: A Technology Infusion Model for Teacher Education," from 10:30–11:30 am in Room S501b/c.
- 2001 Outstanding Technology-Using Leader Award sponsored by ISTE. Congratulations Colleen Seitler, Queensland Society for Information Technology in Education!
- 2001 Outstanding Technology-Using Educator Award sponsored by ISTE. Congratulations Amy Perry, New York!
- Leadership in the Classroom Award sponsored by Tech Corp. Congratulations Robert Carter, Brewster Academy, Wolfeboro, New Hampshire, and Mary Whyte, Moorsbridge Elementary School, Portage, Michigan!
- The Alan Shepard Technology in Education Award presented by Apollo 13 Astronaut, Fred Haise, on behalf of the National Association of Educational Technology Specialists, sponsored by NASA and The Astronauts Memorial Foundation. Congratulations Lori Byrnes, Cypress Ridge Elementary, Clermont, Florida!

IMPORTANT PHONE NUMBERS

- INFORMATION DESK: 312 791 [illegible]
- HOUSING BOOTH: 312 791 [illegible], 312 791 [illegible] [illegible]
- COMMITTEE HEADQUARTERS: 312 791 [illegible] (PH), [illegible]
- WORKSHOP HEADQUARTERS: 312 791 6751 (PH), 312 [illegible] (FAX)
- PRESS ROOM: 312 791 6754, 312 791 6755 (PH), 312 791 [illegible] (FAX)

NECC EVENT TICKETS

Participants taking preregistered tours and events will receive event tickets along with their registration badges. For workshops, Make & Take sessions, the conference luncheon, tours, the Field Museum, and the IPLP Forum, your event ticket is all you need to present at the event to gain admittance. Those attending the Sunday and Monday Cubs games or the trolley tour need to exchange their badge ticket for an official stadium or trolley ticket at the Event & Workshop Tickets Counter at On-Site Registration. Tickets may be available for some events, including workshops. Please check at On-Site Registration in the Grand Concourse.

"ASK ME" INFORMATION VOLUNTEERS

Teams of NECC 2001 volunteers will be available during the conference to provide attendees with quick answers, directions, and other guidance as needed. Look for the big blue "Ask Me" signs!

AUDIOTAPING

Many of the NECC 2001 Program Sessions are being recorded on audiotape and are available for sale to NECC 2001 attendees during and after the conference. Sales are located in the public space on the South Building's Level Four (4), East Concourse. In most instances, session material will be available within one hour of the session's end. An order form for tapes has been included in each registration bag and will be available on the NECC Web site following the conference. Sessions that are being taped will be denoted with a [illegible] icon.

E-MAIL STATIONS

NECC 2001 is happy to provide attendees with high-speed Internet, e-mail, and Web access from approximately 200 workstations located throughout McCormick Place. Access will be available beginning Saturday afternoon, June 23, and will continue throughout the conference. Connectivity is provided by the Illinois Century Network (ICN) and Adobe Systems, Inc. Macintosh and wireless connectivity hardware are provided by Apple. PC Hardware is provided by Gateway, Sun Microsystems, and NIC, Inc.

FOOD SERVICE

On-site food service locations for coffee, breakfast, and lunch include: The Place Room Food Court, Café North, Bar North, McDonalds, and Starbucks. A coffee snack shop is available at the Hyatt Regency McCormick Place along with their full-service restaurant, Networks. Food service is also available in Exhibit Hall A1 during regular exhibit hall hours.

The Chicago Convention and Tourism Bureau is hosting a Concierge Booth located across from Starbucks Coffee on Level 2.5 of the South Building. A concierge will be available to make restaurant recommendations and reservations, assist NECC attendees and exhibitors with Chicago visitor information, and provide maps and guides. **The hours of operation for the Concierge Booth are June 23–26, 10 am–6 pm, and June 27, 10 am–3pm.**

[illegible]

SHUTTLE SERVICE BETWEEN CONFERENCE HOTELS [illegible]

Friday, June 22, 6:30–8:30 pm [illegible]

Saturday, June 23, 6:30 am–6:30 pm [illegible]

Sunday, June 24, 6:30 am–10:30 pm [illegible]

Monday, June 25, 6 am–7 pm [illegible]

Tuesday, June 26, 6:30 am–7 pm [illegible]

Wednesday, June 27, 6:30 am–6 pm [illegible]

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HANDOUTS & RESEARCH PAPERS ON THE WEB

Presenter Handouts and complete Research Papers are available at www.neccsite.org. Presenters can upload their handouts postconference, so check back regularly!

ON-SITE CONFERENCE PLANNER

We are excited to provide attendees with an online conference planner, sponsored by *T.H.E. Journal*. The planner is available exclusively at www.neccsite.org—use one of our 200 e-mail stations or your own machine to plot your daily and weekly NECC schedule of activities. You can choose from workshops, Keynotes, tours, social events, Birds-of-a-Feather Sessions, Concurrent Sessions, Poster and Web Poster Sessions, Student Showcases, Research Papers, and Make & Takes. By establishing a personal log-in ID and saving to the scheduler site, you can maintain and change your schedule as often as you like. You can print out copies of it from any of the on-site e-mail stations. There is one printer for every 10 stations.

PRESS ROOM/ LOUNGE

NECC 2001 will provide members of the national, regional, and local media with a multiactivity Press Room, N426a. Local and long distance (using credit card) telephone and fax service will be available, as will high-speed Internet access. Semi-private areas conducive to one-on-one interviews will also be available on a first-come basis. The Press Room/ Lounge will be open and staffed from 5–7 pm Sunday, 8 am–6 pm Monday and Tuesday, and 8 am–2 pm on Wednesday. For conference updates, a schedule of press-related events, session schedules by topic and theme, access to equipment reserved specifically for the press, and other special requests, please show your press credentials in the Press Room. All registered press must pick up their press ribbon/s in the Press Room; no exceptions will be made.

PRESS STAGE

Members of the media are encouraged to visit the NECC 2001 Press Conference Stage where NECC 2001 exhibitors, sponsors, and speakers will host brief press conferences. Located in the northwest corner of the exhibit hall, the Press Conference Stage will be open and staffed during exhibit hall hours. Press conferences are scheduled for 30-minute time slots and a limited number will be Web cast at www.neccsite.org. A preliminary schedule of Press Conference Stage events will be available in June. Schedule updates will be available on-site in the NECC 2001 Press Room, N426a, and at the Press Conference Stage.

SERVICES FOR PERSONS WITH DISABILITIES

If you require accommodations to attend or participate in NECC 2001, please ask for Jane Bloomquist at the

FOCUS ON WIRELESS

It's everywhere! With all the wireless tools around, NECC is getting on the bandwagon, too, and finding that wireless options are enhancing many facets of the conference. The following wireless activities will be taking place in and around NECC this year:

- **APPLE LAPTOP LOANERS—**
  NECC 2001 attendees can check out Apple iBooks from the NECC registration area and use the wireless network to access e-mail, use the Web, and file share. Checkout is for half-days on a first-come basis beginning Saturday, June 23.
- **PALM OS BEAMING STATIONS—**
  Palm, Inc., presents the NECC 2001 conference schedule on your Palm OS powered handheld. Visit the Palm, Inc. beaming kiosks located in the Palm, Inc. booth and near the NECC Information Booth to download information on exhibits, Keynotes, workshops, and conference sessions. Simple beaming instructions will be provided at the two kiosks, the NECC 2001 Information Booth, and at the Palm, Inc., booth (#2020).
- **APPLE WIRELESS E-MAIL STATIONS & WIRELESS NETWORK—**
  Throughout the meeting space and exhibit hall, attendees can use one of 120 Apple e-mail stations, connected to our wireless network using Apple's patented Airport technology, and access the network using TCP/IP. You can also use your own laptop with an airport-compatible network card and the simple set-up instructions included in your registration bag.
- **GATEWAY WIRELESS WORKSHOP LAB—**
  Take a look at Gateway's new mobile wireless Solo® 5300 solution in our workshop lab, Room N427b/c.
- **PRESENTERS' WORLD, KIDS' CAMP, AND NECC 2001 ON-SITE COMMITTEE COMMUNICATIONS—**
  Courtesy of Motorola and SkyTel/WorldCom, NECC presenters and Kids' Camp participants can explore the potential of using *Timeport* wireless Personal Interactive Communicators to compose, read, and send e-mail, as well as manage contact information and their schedules. The on-site staff, committee, and volunteers are exploring the many ways this technology can enhance their community and communication as well.

NECC 2001 Information Booth. The accessibility desk is located in the information booth and is open during regular registration hours. For information or assistance at other times, call 1.888.562.9650 and leave a message. Real-time captioning and sign language interpreters will be available for each of the keynote sessions. For those sessions not captioned, interpreters for participants who are deaf or hard of hearing will be provided by prearrangement. A limited number of wheelchairs and assistive listening devices will be available on request. Accessible transportation is available, but prearrangement guarantees best service. If possible, please call 1.800.621.4153 by 5 pm the day before service is needed. Please note that it may not be possible to honor requests for accommodations that are made on-site.

LOST & FOUND

Lost and found items may be turned in and retrieved at the NECC 2001 Information Booth until the close of registration on Wednesday, June 27. Items not claimed by that time will be shipped to the NECA Headquarters office in Oregon. Please send inquiries to info@neccsite.org.

DAILY NEWSLETTER

Be sure to pick up the NECC daily newsletter to find out about conference highlights and session changes. The newsletter is available each day at the registration counters, the keynote sessions, and the NECC 2001 Information Booth.

ILLINOIS CPDUs & REGISTRATION

Information and registration will be available at the Illinois CPDUs/NLU University Credit Counter in the Registration area of the Grand Concourse Lobby during the dates and times listed below. Be sure to go to the counter during the registration hours for your specific event: CPDU personnel cannot answer questions about Academic Credit and vice versa.

NECC is recognized by the Illinois State Board of Education (ISBE) as an approved provider of Continuing Professional Development Units (CPDUs). CPDUs for workshops and the conference will equate to one CPDU per one hour of attendance and participation at a workshop or the conference. There is no charge for the CPDUs.

WHAT TO DO ON-SITE

Conference attendees, at the beginning of each day of the general conference, must check in at the Illinois CPDUs/NLU University Credit Counter in the Registration area of the Grand Concourse Lobby so that NECC can time-stamp the Illinois CPDU form. Attendees must return to the counter at the end of the day for closing time-stamping and issuance of their Illinois CPDU forms.

Note: Workshop participants may request an official Illinois CPDU form at the conclusion of their workshops from the workshop presider.

Illinois CPDU Registration Hours: Monday, June 25, 7 am–6 pm; Tuesday, June 26, 7 am–5:45 pm; Wednesday, June 28, 7:30 am–5 pm

NLU UNIVERSITY CREDIT INFORMATION

University credit will be awarded for NECC 2001 conference attendance through National-Louis University. *Note: Workshop attendance does not apply toward university credit.* The NLU Course Title and Description is available at the Illinois CPDUs/NLU University Credit Counter in the Registration area and at www.neccsite.org.

COST AND REQUIREMENTS

The cost for the one semester-hour credit is $209. Credit will be awarded for summer quarter. The written assignment must be submitted by July 15, 2001.

PAYMENT INFORMATION/ WHAT TO DO ON-SITE

Make checks payable to National-Louis University; credit cards are accepted as well. Bring your completed form *and* form of payment to the Illinois CPDUs/NLU University Credit Counter in the Registration area of the Grand Concourse Lobby on Sunday afternoon/evening or Monday morning. You will then receive the official forms you need to have signed by the presenters whose sessions you attend.

University Credit Registration Hours: Sunday, June 24, 3–7 pm; Monday, June 25, 7–11 am, and Tuesday, June 26, 7–11 am

SACK SITTERS, & SHIPPING SERVICE

The Sack Sitters booth is located at the entrance to the exhibit hall. This service will provide:

- UPS shipping: Next Day, Second Day, Three Day, and Ground
- International shipping
- "Rent-A-Box" for session materials and exhibit goodies. A one-time fee buys overnight storage and continual accumulation for the duration of the conference.
- All packaging material purchases, including boxes, packing tape, and labels
- A full-time Traces and Claims office to locate and resolve lost or damaged parcels

Sack Sitters accepts Visa, MasterCard, Amex, Diners Club, checks, cash, and can ship on UPS accounts.

Hours are Monday, June 25, 9 am–6 pm; Tuesday, June 26, 9 am–5:30 pm; and Wednesday, June 27, 9 am–4:30 pm.

LAST-DAY LUGGAGE STORAGE

For your convenience, luggage storage services will be provided by McCormick Place on Wednesday, June 27, on Level 1 by the bus loading/unloading area. $2 per unit.

Hours are 7:30 am–5:30 pm.

NECC 2001/ 2002 SOFTWEAR

Yearning to take back a memento of your time in Chicago? Energized by the promise of a "Nexus in Texas" in 2002? Both the NECC 2001 and NECC 2002 booths, located in the Grand Concourse Lobby, will be selling T-shirts, denim shirts, hats, bandanas, and more during regular registration hours.

NECC 2001 gear will also be available during the NECC 2001 Mini-Mall Tuesday night at Navy Pier. Most items have been produced in limited quantities and sizes—shop early for best selections.

NO SMOKING, PLEASE

NECC 2001 is a non-smoking event. Thank you for your cooperation and attention to ensuring that our learning environment is safe for all participants.

LET US KNOW WHAT YOU THINK!

Included in each *Final Program* is an evaluation form for you to fill out and return to us at either the NECC Closing Session on Wednesday (it's your raffle ticket for prizes) or the NECC 2002 booth. Please take a few moments to let us know what we've done well and what you'd like to see strengthened. Don't forget to put your name on the form if you are using it to enter the Closing Session drawings!

NECC KIDS' CAMP

This year's Kids' Camp will bring Chicago to life and build memories for your children, as we offer three fun-filled days to sample just a few of the exciting attractions Chicago has to offer. Children ages 7–12 are invited to participate in one, two, or all three days' activities. Children will meet at 8 am at the NECC Kids' Camp Check-in Counter in the Grand Concourse Lobby for staging to catch the bus. Parents/guardians can pick up their children at the same location at 4 pm. Adult volunteers will meet the children at the drop-off and pick-up area, and adult chaperones will accompany children for the daily adventures in a 1:5 ratio. Entrance fees to all exhibits and activities and meals (as specified below) are included in the Kids' Camp daily fee. Please note that on-site registration for this event is not available.

MONDAY, JUNE 25, 2001

Shedd Aquarium/Chicago Children's Museum: The camp begins with the famous Shedd Aquarium (www.sheddaquarium.org/) where children tour the exhibits and enjoy a box lunch. The afternoon will be spent at Chicago Children's Museum and the IMax Theater (www.chichildrensmuseum.org).

TUESDAY, JUNE 26, 2001

Museum of Science and Industry: Get ready for lunch, OmniMax movie, and a tour of the Museum of Science and Industry (www.msichicago.org/). Due to a factory relocation, the initial plan to include a visit to the Goelitz Candy Factory has been cancelled.

WEDNESDAY, JUNE 27, 2001

Lincoln Park Zoo: Finally, enjoy a beautiful Chicago day outside at the Lincoln Park Zoo (www.lpzoo.com/). Attendees will be involved in the "Rain Forest Animals" and "Cold-Blooded is Cool" programs, with supervised free roaming of the zoo in between, including gift shop time and a picnic lunch.

ACCESS GRID

Join us for a presentation using the Access Grid, an interactive device that enables group-to-group real-time communication at a distance while using common resources. Come watch Student Showcase presenters and Poster Session presenters as they tell each other about their sessions using this technology. The grid allows for multi-site visual and collaborative experiences for purposes such as:

- Distributed lectures and training seminars
- Remote participation in panel discussions
- Virtual Site visits and meetings
- Complex distributed demonstrations
- Develops New Tools Specifically to Support Group Collaboration

Monday–Wednesday, June 25–27, 10 am–6 pm, Vista Ballroom Lobby (Student Showcases) and S401a (Posters), McCormick Place, South Building

IMMERSADESK

Join us in the Vista Ballroom lobby for a demonstration of Tele-Immersive Learning Environments using the ImmersaDesk. The ImmersaDesk is a versatile, interactive visualization system with the added benefit of true portability and set-up reliability. The large screen display places the user in an immersive, birds-eye view.

Tuesday, June 26, 9 am–6 pm, and Wednesday, June 27, 9 am–3 pm, Vista Ballroom Lobby, McCormick Place, South Building

THE FOLLOWING ACTIVITIES REPRESENT SOME OF THE SPECIAL GATHERINGS HAPPENING IN AND AROUND THE CONFERENCE BEGINNING SATURDAY, JUNE 23. SOME ARE INVITATION ONLY, AND SOME ARE OPEN TO ALL REGISTERED NECC ATTENDEES.

- **ISTE Student Technology Leadership Symposium (by invitation)**
  Saturday, June 23, 8:30 am–midnight, Hilton Garden Inn
- **ISTE Minority Leadership Symposium (by invitation)**
  Saturday, June 23, 9 am–5 pm, Westin-Michigan Avenue, Chicago
- **ISTE Leadership Symposium 2001 (by invitation)**
  Sunday, June 24, 8 am–6:30 pm, Westin-Michigan Avenue, Chicago
- **ISTE Computer Science Symposium (by invitation)**
  Sunday, June 24, 8 am–6:30 pm, Westin-Michigan Avenue, Chicago
- **ISTE Technology & Teacher Education Preconference Symposium (by invitation)**
  Sunday, June 24, 2–6 pm, Westin-Michigan Avenue, Chicago, Michigan Room
- **Jewish Education Network Introductory meeting (open)**
  Sunday, June 24, 5–7 pm, Room S502a, McCormick Place
- **Wideband Gigabit Networking Certification (open). Sponsored by the International Academy of Science**
  Monday, June 25, 8:30 am–noon, 1–5 pm, and Tuesday, June 26, 8:30 am–noon, 1–5 pm, Grand Ballroom S100a, McCormick Place
- **PT^3 Informational Forum, hosted by the U.S. Department of Education (by invitation)**
  Monday, June 25, 5–7 pm, Room N426c, McCormick Place
- **CEO Forum**
  Monday, June 25, 1–3 pm, General Session Hall B1, McCormick Place
- **Defining the Characteristics of Effective Ed Tech School Leaders (open), hosted by development leaders from NetDay**
  Monday, June 25, 5–6 pm, S502b, McCormick Place, South Building
- **Youth Empowerment Project Planning Meeting (YEP) (by invitation), sponsored by Generation Yes and ISTE**
  Tuesday, June 26, 10 am–6 pm, Regency Ballroom C, Hyatt McCormick Place
- **NECC 2001 Administrators' Forum (open). Sponsored by Chancery Software and Microsoft in Education**
  Tuesday, June 26, noon–6 pm, Regency Ballrooms A/B, Hyatt McCormick Place
- **NECA LIGHTS Reception (by invitation)**
  Tuesday, June 26, 4–5 pm, Regency Ballroom E, Hyatt McCormick Place
- **Illinois Computing Educators Member Reception (open to all ICE-IL members)**
  Tuesday, June 26, 5–6:30 pm, Room TBD, Sheraton Chicago
- **Michigan Association for Computer Use in Learning (MACUL) Member Reception (open to all MACUL members)**
  Tuesday, June 26, 6:30–8 pm, Sheraton Chicago, Michigan A
- **New York State Association for Computers & Technologies in Education (NYSCATE) Member Reception (open to all NYSCATE members)**
  Tuesday, June 26, 6:30–8 pm, Room TBD, Hyatt Regency
- **The Collaboratory Project Reception for Illinois Educators (by invitation)**
  Tuesday, June 24, 4–6 pm, Regency Ballroom D, Hyatt McCormick Place
- **Teacher Educators' Technology Forum (ticket purchase required), sponsored and organized by the Illinois Professional Learner's Partnership (IPLP)**
  Wednesday, June 27, 8:30 am–8 pm, Regency Ballrooms A/B, Hyatt McCormick Place

ISTE MEETINGS

Saturday, June 23, 2001

ISTE Affiliates Meeting, 8 am–5 pm, Westin-Michigan Avenue, Chicago, Buckingham Room

Sunday, June 24, 2001

SIG Teacher Educators (SIGTE) Forum, 2–6 pm, Westin-Michigan Avenue, Chicago, Michigan Room

Monday, June 25, 2001

ISTE Student Leadership Initiative Committee, 8–9 am, Room N426c*

ISTE Membership Meeting, 12:30–1:45 pm, Room N426c*

CARET Advisors Meeting, 1:45–3:15 pm, Room N426c*

SIG Hypermedia/Multimedia, 3:30–4:45 pm, Room N426c*

Tuesday, June 26, 2001

ISTE Affiliate Executive Board, 7:30–9 am, Room N426c*

SIG Technology Coordinators (SIGTC), 10:30–11:45 am, Room N426c*

SIG Computer Science (SIGCS), 12 noon–1:15 pm, Room N426c*

SIGTelecommunications (SIGTL), 1:30–2:45 pm, Room N426c*

SIG Teacher Educators (SIGTE), 3–4:15 pm, Room N426c*

L&L Authors Past, Present, & Future: Meet, Greet & Eat, 5:45–6:45 pm, Room N248c*

Wednesday, June 27, 2001

SIG Special Education (SIGSpEd), 10:30–11:45 pm, Room N426c*

**McCormick Place, North Building*

SHUTTLE & GROUND TRANSPORTATION

Approximate transit time between most hotels and McCormick Place is 30 minutes; please plan accordingly. Many events, including workshops, do not provide alternatives for late arrivals, and some do not allow late entrance.

Unless otherwise noted, shuttles will depart from and return to Transportation Gates 2 & 3 outside the 100-level meeting rooms in the South Building. This schedule is subject to revision and was accurate as of press time. Please do not forget to check the transportation staging area at McCormick Place and your hotel lobbies for up-to-date frequency, dates, and changes. Though this schedule may also be affected by traffic conditions and other events taking place in the Chicago downtown area, every effort is being made to ensure that your transportation service is timely, comfortable, and consistent. Please let our service providers, American Sightseeing Chicago, know if your experience is otherwise.

Schedules are available on page 9 in this booklet, in the transportation staging area, and at the NECC 2001 Information Desk in the On-Site Registration area.

- Transportation for all NECC Tours is included with the tour information on page 15.
- Transportation information for NECC workshops is included with the workshop information on pages 59–63.
- For accessible transportation, prearrangement guarantees best service. Please call 1.800.621.4153 by 5 pm the day before service is needed.

SECONDARY GROUND TRANSPORTATION ALTERNATIVES

The Chicago Transit Authority (CTA), the city's public bus and train service, will get you just about anywhere for less than $2 each way. You can use the CTA to get from O'Hare to your hotel in downtown Chicago. Note that depending on the address of your hotel, this may involve a transfer from a train to a bus (at no extra cost) and a short walk or cab ride. CTA visitor passes are available for purchase online at www.transitchicago.com or at the airport. CTA passes provide unlimited bus/train rides during a five-day period for $18, or at a reduced cost for one-, two-, or three-day periods.

Two other bus and rail companies, PACE and METRA, also operate in and around Chicago. Information about routes and fares on both of them, as well as the CTA, is available at www.RTAChicago.com or by calling 312.836.7000. If you call, be prepared to tell the operator the intersections you are traveling between, so she/he can plot your route.

If your flight gets in or leaves after dark, you might prefer to use the Airport Express Shuttle Service that serves many of the downtown hotels. The cost is about $19 for a one-way ticket and takes a little more than an hour. Call your hotel for details.

Taxis from O'Hare to and from most downtown hotels cost about $40 and take about an hour.

DOWNTOWN CHICAGO ACCOMMODATIONS

Allerton Crowne Plaza Hotel	**Tel: 312.440.1500**	**701 N. Michigan Avenue**
Best Western Inn of Chicago	**Tel: 312.787.3100**	**162 E. Ohio Street**
Chicago Marriott Downtown	**Tel: 312.836.0100**	**540 N. Michigan Avenue**
Courtyard by Marriott Chicago Downtown	**Tel: 312.329.2500**	**30 E. Hubbard Street • State Street**
Doubletree Guest Suites Chicago	**Tel: 312.664.1100**	**198 E. Delaware Place**
Drake Hotel	**Tel: 312.787.2200**	**140 Walton Place**
Embassy Suites Chicago–Downtown	**Tel: 312.943.3800**	**600 N. State Street**
Fairfield Inn & Suites Chicago Downtown	**Tel: 312.787.3777**	**216 E. Ontario Street**
Hampton Inn & Suites Chicago	**Tel: 312.832.0330**	**33 West Illinois Street**
Hilton Garden Inn Chicago	**Tel: 312.595.0000**	**10 E. Grand Avenue**
Holiday Inn–Chicago City Center	**Tel: 312.787.6100**	**300 E. Ohio Street**
Holiday Inn–Chicago Mart Plaza	**Tel: 312.836.5000**	**350 N. Orleans Street**
Hotel Inter.Continental Chicago	**Tel: 312.944.4100**	**505 N. Michigan Avenue**
Hyatt Regency Chicago	**Tel: 312.565.1234**	**151 E. Wacker Drive**
Hyatt Regency McCormick Place	**Tel: 312.567.1234**	**2233 S. Martin Luther King Drive**
Millennium Knickerbocker Hotel	**Tel: 312.751.8100**	**163 E. Walton Place**
Omni Chicago Hotel	**Tel: 312.944.6664**	**676 N. Michigan Avenue**
Raphael Hotel	**Tel: 312.943.5000**	**201 E. Delaware Place**
Red Roof Inn	**Tel: 312.787.3580**	**162 East Ontario Street**
Sheraton Chicago Hotel & Towers	**Tel: 312.464.1000**	**301 E. North Water Street**
Summerfield Suites Hotel	**Tel: 312.787.6000**	**166 E. Superior Street**
Swissotel Chicago	**Tel: 312.565.0565**	**323 E. Wacker Drive**
Tremont Hotel	**Tel: 312.751.1900**	**100 E. Chestnut Street**
Westin Michigan Avenue Chicago	**Tel: 312.943.7200**	**909 Michigan Avenue**
Wyndham Chicago Downtown	**Tel: 312.573.0300**	**633 North St. Clair Street**

NECC 2001 TOURS

Whether you prefer organized tours or exploring the [illegible] on your own, NECC 2001 and the people of Chicago welcome you and are ready to show you the time of your life! The following tours are offered in conjunction with NECC 2001. Seats for some may be still available—check at On-Site Registration in the Grand Concourse Lobby. All require prepayment and advance registration. Tour guides, with signs for each tour, will meet participants near the greeter station in the transportation loading area.

		Tour Time	Bus Boarding
Saturday, June 23	**The Grand Tour and Sears Tower**	**9:30 am–3 pm**	**9:15 am**
Saturday, June 23	**Land and Lake Tour** *Return transportation is not provided for this tour.*	**3:30 pm–8:30 pm**	**3:15 pm**
	Roaring Twenties Dinner Tour *Return transportation will only be to selected NECC conference hotels.*	**6:30 pm–11 pm**	**6:15 pm**
Sunday, June 24	**Historic Oak Park & Frank Lloyd Wright**	**9 am–1 pm**	**8:45 am**
Monday, June 25	**The Grand Tour and Sears Tower**	**9:30 am–2:30 pm**	**9:15 am**
	Land and Lake Tour *Return transportation is not provided for this tour.*	**3:30 pm–8:30 pm**	**3:15 pm**
Tuesday, June 26	**Architectural Delight River Cruise & Loop Walk** *Return transportation will only be to selected conference hotels and McCormick Place.*	**9:30 am–3:30 pm**	**9:15am**
Wednesday, June 27	**Land and Lake Tour** *Return transportation will only be to selected conference hotels and McCormick Place.*	**3:30 pm–8:30 pm**	**3:15 pm**

ART INSTITUTE OF CHICAGO*

Sunday, June 24	Art Institute of Chicago	1:30–2:30 pm	N/A
Wednesday, June 27	Art Institute of Chicago	10:30–11:30 am	N/A

- **No transportation provided.** All participants should meet the Museum docent (guide) on the Michigan Avenue steps of the Art Institute a half-hour prior to the tour start time. Late arrivals will not be able to enter once the docent has begun the tour.

TROLLEY TOURS

Enjoy a scenic tour of Chicago's lakefront and downtown area aboard new trolley buses, similar to cable cars in San Francisco. Stops include the Field Museum, Adler Planetarium, the Shedd Aquarium, the Art Institute, Sears Tower, Navy Pier, and Water Tower Place. Tour price does not include admission to attractions.

This is a self-guided tour. A brochure indicating all the stops and trolley loading locations will be provided at the ticket exchange booth at On-Site Registration. **Please Note:** You must go to the Cubs/Trolley ticket exchange counter at On-Site Registration to exchange the ticket from your badge sheet for an actual Trolley ticket. *Saturday, June 23, 9 am–5 pm; Sunday, June 24, 9 am–5 pm; Wednesday, June 27, 9 am–5 pm*

CUBS BASEBALL GAMES

Sunday, June 24	Chicago Cubs vs Milwaukee Brewers	1:20 pm	Gametime
Monday, June 25	Chicago Cubs vs New York Mets	7:05 pm	Gametime

Transportation to and from the game is not provided; your hotel concierge can provide you with the available transportation options. Please Note: You must go to On-Site Registration to exchange the ticket from your badge sheet for an actual Cubs game ticket...the ticket takers at Wrigley won't accept NECC coupons! The NECC 2001 ticket block was sold out as of press time.

TOUR CANCELLATION POLICY

Tour cancellations must have been requested by May 15 to receive a refund. There will be no refunds issued to tour participants unless the tour seat is resold through On-Site Registration. Refunds are contingent on ticket resale and are not guaranteed.

BUILDING ON THE FU

Welcome to the 22nd annual National Educational Computing Conference...

T [illegible]

NECC 2001 Program Co-chairs

NECC 2001 PROGRAM FEATURES

KEYNOTES
Designed to inspire and educate, Keynotes are offered once at the beginning of each conference day and at the conference luncheon. See page 4.

CONCURRENT SESSIONS
Offered in one-hour panel, team, or individual formats, Concurrent Sessions highlight the successful programs, projects, ideas, and concepts of educators from all levels. Spotlight Sessions are a special category of Concurrent Sessions and feature recognized leaders in educational technology.

RESEARCH PAPERS
Offered as part of the Concurrent Sessions, Paper Sessions feature two peer-juried original research papers per one-hour time slot on the general theme of using technologies to enhance education. PDFs of papers appear on the NECC 2001 Web site. A discussant will lead each session.

POSTERS & WEB POSTER SESSIONS
These two-hour sessions allow participants to engage in one-on-one or small-group discussions featuring both hard media and electronic displays. Web Posters include the enhancement of Internet connectivity. Attendees can view 12 Posters and 12 Web Posters at each time block.

STUDENT SHOWCASES
In these two-hour sessions, students and teachers demonstrate how they use technology in their classrooms.

See pages 18–51 for a listing by day and time of all session categories listed above.

MAKE & TAKE SESSIONS
These two-hour sessions offer hands-on activities to small collaborative groups aimed at learning to use technology to create a product or project that participants can then take home. Additional fee ($10) and advance registration are required. Seats may still be available. Stop by On-Site Registration for details. See page 58.

WORKSHOPS
Workshops are designed to provide in-depth exploration of specific issues and topics. Available in 3-, 6-, and 12-hour (two-day) segments in both hands-on and seminar/demo formats. Workshops require an additional fee and advance registration. Seats may still be available. Stop by On-Site Registration for details. See pages 59–63.

NECC 2001 Keynotes are...

- ***Steve Jobs, Monday, June 25***
- ***Janiece Webb & John Stupka, Tuesday, June 26***
- ***Hilarie Davis & Colleagues, Wednesday, June 27***
- ***Debbie Silver, Wednesday Luncheon***

Session summaries, handouts, & PDFs of research papers are available at www.neccsite.org.

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TURE

What is NETS?

NETS stands for ISTE's National Educational Technology Standards projects. NETS defines what students and teachers should know and be able to do with technology. ISTE worked with a broad coalition of educators, curriculum associations, and other educational organizations to develop and come to consensus on these standards. For more information on NETS, see www.iste.org.

Look for the following NETS classifications following session listings in this program whenever applicable.

NETS for Students (NETS•S) are organized into the following categories:

1. Basic operations and concepts
2. Social, ethical, and human issues
3. Technology productivity tools
4. Technology communications tools
5. Technology research tools
6. Technology problem-solving and decision-making tools

NETS for Teachers (NETS•T) are organized into the following categories:

- i. Technology operations and concepts
- ii. Planning and designing learning environments and experiences
- iii. Teaching, learning, and the curriculum
- iv. Assessment and evaluation
- v. Productivity and professional practice
- vi. Social, ethical, legal, and human issues

PROGRAM THEMES

BUILDING A FRAMEWORK

BUILDING TECHNOLOGY CAPACITY

BUILDING HUMAN CAPACITY

Professional Development, Preservice Teacher Preparation, Leadership and Competencies, Standards, and Certification

BUILDING A LEARNING ENVIRONMENT

Early Childhood/Elementary, Language Arts/Social Studies, Math/Science, Computer Science, Other Subjects, Special Populations, Multimedia/Virtual Reality, Internet/Web, Technology Integration, Instructional Strategies & Classroom Management with Technology, Project Based and Problem-Based Curricula, Problem Solving and Critical Thinking and Cooperative/Collaborative Learning, Distance/Distributed Learning, Literacies for the Information Age, Research and Best Practices in Teaching and Learning, Student Assessment, and Multiple Intelligences, Laptop Learning

BUILDING EQUITY AND ACCOUNTABILITY

ON-SITE CONFERENCE PLANNER

We are excited to provide attendees with an online conference planner, sponsored by *T.H.E. Journal*. The planner is available exclusively at www.neccsite.org—use one of our 200 e-mail stations or your own machine to plot your daily and weekly NECC schedule of activities. You can choose from Workshops, Keynotes, tours, social events, Birds-of-a-Feather Sessions, Concurrent Sessions, Poster and Web Poster Sessions, Student Showcases, Research Papers, and Make & Takes. By establishing a personal log-in ID and saving to the scheduler site, you can maintain and change your schedule as often as you like. You can print out copies of it from any of the on-site e-mail stations. There is one printer for every 10 stations.

DON'T FORGET YOUR MINI-MATRIX!

The mini-matrix includes a listing of all concurrent sessions in day, time order.

AUDIOTAPING

Many of the NECC 2001 Program Sessions are being recorded on audiotape and are available for sale to NECC 2001 attendees during and after the conference. Sales are located in the public space on the Fourth Floor, East Concourse (follow the signs). In most instances, session material will be available within one hour of the session's end. An order form for tapes has been included in each registration bag and will be available on the NECC Web site following the conference. Sessions that are being taped will be denoted with a ▭ icon.

SAMPLE SESSION LISTING

SESSION TITLE	**Internet2 and K–12 Opportunities**
PRESENTER(S)	*Gary Greenberg, Northwestern University (IL)*
ROOM NUMBER AT MCCORMICK PLACE	**Room: S106**
SESSIONS WITH THIS ICON WILL BE AUDIO TAPED. TAPES CAN BE PURCHASED IN THE PUBLIC SPACE ON THE FOURTH FLOOR, EAST CONCOURSE, BY USING THE ORDER FORM IN YOUR REGISTRATION MATERIALS.	▭
DESCRIPTION	Find out what Internet2 projects and activities mean for K–12 education today and tomorrow and when and how K–12 will be able to participate.
AUDIENCE LEVEL; AUDIENCE; NETS FOR STUDENTS AND/OR NETS FOR TEACHERS WHEN APPLICABLE	*General; Teachers, Technology Coordinators, Library/Media Specialists, Administrators*

MONDAY KEYNOTE, 8:30–10 AM

GENERAL SESSION HALL B1

STEVE JOBS, CEO APPLE

Steve Jobs is CEO of Apple, a leader in personal computing devices he co-founded in 1976, and CEO of Pixar®, the Academy Award®–winning computer animation studios he co-founded in 1986. Steve grew up in the apricot orchards that later became known as Silicon Valley, and he still lives there with his wife and three children.

MONDAY, 10 AM–12 NOON

STUDENT SHOWCASE

All Showcases take place in the Vista Ballroom Lobby.

Kiosks to Connect our Community with our Schools

Kenneth Albert, Niles North High School (IL), Omar Khalid, Lee Gonye, Erik Christiansen, Steven Pearson

Table 3

In this problem-based learning activity, students researched, designed, and built a Web-based school-information kiosk for their community.

9–12; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators

Primary Achievement Center and Fieldcrest Elementary School

Jennifer Mulchhall, Lightspan, Inc. (CA), Denise Jullian (IL), Ingrid Stevens (IL)

Table 2

Primary Achievement Center and Fieldcrest Elementary School are successfully using educational software and the Internet to raise student achievement, increase family involvement, and boost motivation.

K–8; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators

Multimedia Learning Stories by Wildwood School Students

Karen Porach, Wildwood School (IL)

Table 1

Students tell what they learned in school today with these multimedia projects. See a variety of multimedia stories told by students at Wildwood School in Chicago.

K–8; Teachers, Technology Coordinators, Teacher Educators, Library Media Specialists, Administrators

POSTERS

All posters take place in Room S401a.

Software Toolkits That Maximize Money and Minimize Hassles Has Goal

Mary Pyatt, DODDS (Germany AE), Tara Blum, Orva Biddle, Tina Perrault, Beverly Staub

Table 12

Our district software toolkit is limited, but it stretches across curriculum and grade levels. These educational applications provide teachers with performance-based learning tools for assessment.

K–12; Teachers, Technology Coordinators, Staff Developers, Administrators

Coaching: The "Cadillac" Staff Development Vehicle

Jodi Garton, Greenfield School District (WI), Marilyn Kemp, Gloria Pianta

Table 11

Find out how coaching can increase computer skills, job performance, and technology integration proficiencies in public school and public library staff.

General; Teachers, Technology Coordinators, Staff Developers, Administrators

Let Your Students Effectively Learn Technology Using Individualized Units

Brenda Greenwald, Beatrice Senior High School (NE)

Table 10

Do all students need or want the same opportunities? How can you adjust your technology curriculum to narrow the widening gaps in prior student knowledge?

6–12; Teachers, Administrators

Technology-Based Author Studies

Vicki Irgang, Brooklyn College (NY), Martha Hannigan, Zena Grunwald

Table 8

The Technology-Based Author Studies method incorporates standards-based teaching methodologies into a framework for classroom instruction that promotes higher-order thinking skills and multiple intelligences.

K–12, University/College, Community College; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators

Are Technologically Literate Classrooms a Reality?

Doris Johnson, Wright State University (OH)

Table 3

Discuss ideas for project-based teaching approaches and integrating classroom technology. Educational institutions must prepare tomorrow teachers for incorporating technology into their teaching.

K–12, University/College, Community College; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Administrators

CCS Web Academy Reshapes Classrooms of the Future

Allen Jordan, Cumberland County Schools' Web Academy (NC), H. Robert Bohon, Mitty Jenkins

Table 7

The Cumberland County Schools' Web Academy was created to provide a totally different teaching and learning environment constructed in software.

9–12; Teachers, Technology Coordinators, Staff Developers, Administrators

Technology and Staff Development: A Successful Model

Robin McCartney, Loup City Public Schools (NE), Marvin Harkness

Table 9

Find out about a successful model that provides staff development and integrates technology with existing curricula to enhance student learning.

General; Teachers, Technology Coordinators, Staff Developers, Administrators

2001 Odyssey: Teaching Students Using Technology

Josie McClure, Prato Elementary (TX), Maria Pilar Medina, Patty Urias, Margie Villanueva

Table 6

Three elementary teachers, monolingual and bilingual, and the literacy leader demonstrate successful integration of technology and the Internet into the classroom and the work environment.

K–8, University/College, Community College; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators

Eyewitness to History

Patti Olson, Las Vegas City Schools (NM)

Table 5

Students use technology to document intergenerational experiences in northern New Mexico. Multimedia projects will compare and contrast the period of westward expansion and life in the early 20th century.

6–8; Teachers, Technology Coordinators, Teacher Educators

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A Thematic Approach to Integrating Technology into a Standards-Based Curriculum

Angie Pitts, Orange Grove Elementary (SC), Catherine Musgrove

Table 4

Third graders use a "Three Little Pigs" unit to integrate technology into the classroom and computer curriculum. Receive a copy of this unit.

K–3; Teachers, Library/Media Specialists; NETS•S: 3–6

Assistive Technology for the Classroom Teacher

Dave Rees, Queen Anne's County Public Schools (MD), Brenda Rees

Table 2

See teacher-designed activities in which assistive technology was used so all students could be included in their classrooms in a variety of settings.

General; Teachers, Teacher Educators, Staff Developers, Administrators; NETS•T: I–VI

The Digital Camera and Its Uses in Your Classroom

Andy Vantrease, Rich Central High School (IL)

Table 1

Digital cameras will be available for hands-on activities. See sample classroom activities and lesson plans and then take them home.

General; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators

WEB POSTERS

All posters take place in Room S401a.

Project-Based Learning with classrooms@work

Anne Batey, Northwest Educational Technology Consortium (OR), Amy Pearl

Table 13

Learn about effective classrooms@work on technology-supported projects. Get the details on roller coaster design (middle school), world geography research challenges (high school), or persuasive teams presenting travel proposals (elementary school).

4–12, University/College; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists

"Weaving an Interdisciplinary Web: Integrated Curriculum at Its Best"

Pby Chapman, Germantown Academy (PA), Susan Mannheimer-Huff

Table 21

Explore a dynamic, kid-driven Web site, rich in integrated technologies and interdisciplinary connections. See the latest technologies used in dynamic ways by students as young as 10!

General; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists

The National Pet Census: An Internet-Based Project for Elementary Students

Paula Don, School District of Philadelphia (PA)

Table 17

Find out about the National Pet Census, a collaborative Internet-based project in which participating schools collect and analyze data from across the country.

General; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists; NETS•S: 1, 3–5

DisneyLearning.org—An Online Resource for Teachers and Parents

Kathy Franklin, Disney Learning Partnership (CA)

Table 22

Learn about our innovative online workshops, free tools for teachers, and unique resources designed to help educators and families work together effectively.

General; Teachers, Teacher Educators, Staff Developers, Administrators

For the Common Good: 400+ Standards-Based, Teacher-Tested Lessons

Rita Higgins, Learning to Give, K–12 Education in Philanthropy Project (MI), Barbara Dillbeck

Table 20

Create a classroom setting where students feel empowered to make positive changes in their community and their world. Find more than 400 standards-based, teacher-tested lessons at http://k12edphil.org.

General; Teachers, Technology Coordinators, Staff Developers, Library/Media Specialists, Administrators

The Teacher Tap: An Online Professional Development Resource

Annette Lamb, Lamb Learning Group (TX), Larry Johnson

Table 10

The Teacher Tap (http://eduscapes.com/tap) is a free professional development resource that helps educators address common technology integration questions by providing practical online resources and activities.

General; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators

YouthlineUSA: Integrate Reading, Technology, and Career Training into the Classroom

Darlene Rice, Youthline USA (NJ), Jeryl Deppeler, Malcolm Ligon

Table 24

Use the Internet to merge the reading curriculum, technology, and career training. A daily news site teaches reading while students learn about the world.

4–8; Teachers, Technology Coordinators, Staff Developers, Administrators

Internet Video Resources in the Classroom

Bart Rose, Baltimore City Public School System (MD), Bill Swanson, Roy Hawkins

Table 18

The Baltimore Learning Community Project provides high-quality video resources freely downloaded from the Internet to the desktop. See examples of learning activities.

4–12; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators

Technology, Critical Literacy, and Chicano Studies

Harry Stone, Memorial Academy Charter School (CA), Ernesto Bustillos

Table 23

Get your students interested through culture, technology, and critical education. This is a demonstration of successful units involving critical pedagogy/literacy and Chicano history.

6–12; Teachers, Technology Coordinators, Staff Developers, Library/Media Specialists

Read, Write, Compute: Project-Based Learning to Build On

Nicki Vitelle, Germantown Academy (PA), Andrea Owens

Table 15

Learn about a summer language program that is entertaining and educational and integrates technology within themes: mystery, adventure, chocolate, and fantasy.

K–6; Teachers, Technology Coordinators, Library/Media Specialists, Administrators

Math CyberKids and the Internet—It's Elementary!

Patricia Wong, Delmar Elementary School (MD), Cecilia Hardwick

Table 30

Explore online projects that bring together math concepts, inquiry, technology, collaborative learning, and real-world meanings in the classroom while addressing learner outcomes.

K–6; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators; NETS•S: 1–6; NETS•T: I–VI

University of Idaho EdTechQuest: Multimedia Competition and Online Workshop

Eleanor Wright, University of Idaho (WA), Jeff Marten, Carma Tank

Table 14

The University of Idaho Educational Technology Institute Training Teams proudly present the EdTechQuest. This Web page session is an overview of our unique multimedia competition.

General; Teachers, Technology Coordinators, Staff Developers, Administrators

MONDAY, 11 AM–12 NOON

★ SPOTLIGHT SESSIONS

Internet2 and K–12 Opportunities

Gary Greenberg, Northwestern University (IL)

Room S100

Find out what Internet2 projects and activities mean for K–12 education today and tomorrow and when and how K–12 will be able to participate.

General; Teachers, Technology Coordinators, Library/Media Specialists, Administrators

New Horizons: From Gutenberg to Gates and Beyond

Ted McCain, Thornburg Center for Professional Development (BC, Canada), Ian Jukes

Room: Vista Ballroom (S402a)

Gutenberg's printing press ignited the Renaissance, just as the Internet is igniting the Digital Renaissance. Reconsider education as we move from Gutenberg to Gates.

General; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators

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MONDAY, 11 AM–12 NOON, CONTINUED

SPOTLIGHT SESSIONS, CONTINUED

Technology Accountability: Should We Unplug Our Expectations for Student Results?

Benjamin Porter, Education Technology Planners, Inc. (CO)

Room: Vista Ballroom [illegible]

It is time to step up to the task of organizing and measuring technology investments for visible educational results. If the task is really beyond our capabilities and resources, we must unplug our expectations and funding.

General; Technology Coordinators, Administrators, Staff Developers

CONCURRENT SESSIONS

BUILDING A FRAMEWORK

Academic Standards and Technology in Plain English

Scott Garrigan, Bethlehem Area School District (PA)

Room: [illegible]

Educators struggle with two challenges: "becoming standards-based" and "integrating technology into the curriculum." In plain English, learn to combine both through research-based solutions.

K–12; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Administrators

BUILDING TECHNOLOGY CAPACITY

An Experiment in Thin-Client Computing

Carlo Hansen, North West Catholic School Division (Canada)

Room: [illegible]

Find out about the successes and failures of a school division that sold all of its computers and entered into a thin-client pilot program with Sun Microsystems.

K–12; Teachers, Technology Coordinators, Administrators

Tech Savvy: Funding for K–12 Technology Education Programs

[illegible], American Association of University Women (AAUW) Educational Foundation (DC)

Room: [illegible]

Gain an understanding of the latest research on gender differences in computer education and learn how to apply for funding for technology projects.

General; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators

BUILDING HUMAN CAPACITY

Professional Development

An Evaluation Framework: Brazos-Sabine Connection, a TLCF Project

Kay Abernathy, Brazos-Sabine Connection Project/Lumberton ISD (TX), Jennifer Berglund, Sherrie Leach, Linda VanWagner, Joyce Logan, Larry Dickerson, David Wallace (MD)

Room: [illegible]

Evaluation of program effects—a priority in the Brazos-Sabine Connection Project—brought new learning about technology integration in teaching and learning to 15 school districts.

General; Technology Coordinators, Teacher Educators, Staff Developers, Administrators; NETS•T: i–iii

Professional Development—Making a Difference in Reading, Writing, and Math

Judy Fisher, ABC Technology in Education Consortium (NC), Zelia Frick, Sandra Davis, Charles Parker, Donna Yow

Room: [illegible]

Find out about a professional development model that is producing improved student achievement in reading, writing, and math. Technology is the cohesive tool used to address student needs.

General; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators; NETS•S: 3; NETS•T: ii

PBS: Online Resources and Professional Development for Teachers

Mary Hatham, PBS Online Education (VA), Jon Cecil, Stephen Kesblock

Room: [illegible]

PBS isn't just television! Learn about the broad array of PBS services and products for teachers, including curricular materials, professional development, and standards-based learning tools.

General; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators

Preservice Teacher Preparation

The Impact of Electronic Portfolios on Preservice Elementary Teachers

Jane Strickland, Idaho State University, Michael Jinks, Chris Williams

Room: [illegible]

Discuss the creation of digital portfolios by preservice elementary teachers. Also find out about the correlation with early field experience and see example portfolios.

6–12, University/College, Community College Teachers, Teacher Educators; NETS•T: ii–vi

Productive Partnerships

Sharon VanMetre, McNeese State University (LA)

Room: [illegible]

Early in their teacher preparation program, students of McNeese State University are partnered with inservice teachers to assist in the development of technology-rich units of study for the K–12 classrooms of the area.

University/College Teachers, Teacher Educators

Leadership and Competencies, Standards, and Certification

Design and Develop Standards-Based Electronic Portfolios

Helen Barrett, University of Alaska–Anchorage

Room: [illegible]

How do standards fit into designing and developing electronic portfolios? Combine multimedia skills with the portfolio development process to create a standards-based electronic portfolio.

General; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Administrators; NETS•T: iv

Internet Tools, Applications, and Sites Every School Leader Should Know

Douglas Sebring, North Olmsted City Schools (OH), Geoff Andrews

Room: [illegible]

Experience an introduction to and interaction with basic elements (hardware, software, and techniques) necessary for school leaders to use the Internet effectively.

K–12; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators

BUILDING A LEARNING ENVIRONMENT

Early Childhood/Elementary

Early Literacy and Technology: Positively Impacting Student Achievement

Betty Chambers, Montgomery County Public Schools (MD)

Room: [illegible]

Learn how technology enhances early literacy instruction and improves student achievement by seeing teachers and students from the Early Childhood Technology Literacy Project in action.

K–3; Teachers, Technology Coordinators, Teacher Educators, Staff Developers; NETS•S: 1–6; NETS•T: ii–iv

Language Arts/Social Studies

Collaboration in Developing a Web Site of Primary Source Materials

Kathleen Vest, Project WhistleStop United States Technology Innovation Challenge Grant (MO), Thomas Kochanek

Room: [illegible]

Project WhistleStop, a technology project with the Truman Library, shares supportive strategies for others seeking to develop Web site partnerships with museums or libraries.

General; Teachers, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators

Math/Science

Math for Students, Teachers, and Parents—Anytime, Anywhere

Connie Dowd, Riverdeep Interactive (MA)

Room: [illegible]

Hear how Riverdeep is providing comprehensive curricula directly accessible on the Internet, thus breaking down existing barriers between home and school.

(Exhibitor presentation)

K–12; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Administrators; NETS•S: 3, 6; NETS•T: ii–v

Shadow-a-Swan: Students Improve the Migration Corridor

Brandon Thacker, Davis School District (UT), Dwight Brown, Allison Riddle

Room: [illegible]

Can telecollaborative science enhance science scores and help the Tundra Swan thrive? Experience this award-winning NSF/NCTM Web site and join the project if you desire: it's free!

K–12; Teachers, Technology Coordinators, Administrators, Staff Developers

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Computer Science

Teaching with Java: The Good, the Bad, and the Opportunity

Tim Wise, Holt Software (ON, Canada)

Room: S404d

Examine important issues such as student expectations, development environments, hardware requirements, teaching issues (objects first), and questions such as "What about the AP exam?"

9–12, University/College, Community College; Teachers, Technology Coordinators

Multimedia/ Virtual Reality

Multimedia Production in the Classroom: Tips, Tricks, and Helpful Hints

Abbie Brown, Washington State University (WA), Timothy Green (CA)

Room: S105a

A set of guidelines and resources based on research and personal experiences that may facilitate the management of multimedia production projects in K–12 classroom settings.

University/College, Community College; Teachers, Teacher Educators, Library/Media Specialists; NETS•S: 3; NETS•T: ii, iii

Technology Integration

Introducing Kidspiration™ from Inspiration Software, Inc.

Robin Christensen, Inspiration Software, Inc. (OR)

Room: S106d

Kidspiration helps primary students brainstorm ideas with words and pictures, organize, categorize information, create stories, and explore new ideas with thought webs and visual mapping. *(Exhibitor presentation)*

K–3; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators

Showcasing Our Best Teacher-Created Lessons: A Story of Collaboration

Ann Vedantham, Atlantic County ETTC at Stockton College (NJ), Jung Lee

Room: S504b/c

African masks, tessellations, multicultural art … Take a look at these award-winning teacher-created lessons from our annual contests and explore creative ways to integrate technology, instructional components, interdisciplinary connections, and collaborative structures that make them great!

General; Teachers, Teacher Educators, Library/Media Specialists, Administrators

Instructional Strategies & Classroom Management with Technology

A Teacher's Favorite Software Collection: 2001

Bob Burkett, Super School Software (CA)

Room: S100

Lesson Plan Designer, IEP Writer, The Super School Portfolio Assessment Kit, Test Designer Supreme, and The Teacher Tools Success Pack will be demonstrated. *(Exhibitor presentation)*

K–12, University/College, Community College; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators; NETS•S: 3; NETS•T: ii, iv, v

A Different and Better Way of "Doing School"

Alan Whitworth, Jefferson County Public Schools (KY)

Room: S105b/c

Find out about a learning model in which students create deeper understandings and collaboratively build a knowledge base—a model employed in more than 120 Kentucky classrooms.

4–12, University/College; Teachers, Technology Coordinators, Staff Developers, Administrators

Project-Based and Problem-Based Curricula, Problem Solving and Critical Thinking, and Cooperative/ Collaborative Learning

Enhance Thematic Units with Simple Computer Activities

Rae Witter, Consultant (NH)

Room: S105b/c

Learn to develop thematic units with motivational computer activities using the Internet and available software. Leave with a wealth of resources and ideas.

General; Teachers, Teacher Educators, Staff Developers, Library/Media Specialists; NETS•S: 1–6; NETS•T: ii–vi

Distance/Distributed Learning

A Distance Master's Degree Program for 2,500 Professors

Francisco Corredor, CHDET/DGITISEP (Mexico), Ricardo Campos

Room: S101a

A graduate program on science teaching is being offered on the Internet to 2,500 professors located all over Mexico. Learn about its development and current state.

9–12, University/College, Community College; Technology Coordinators, Teacher Educators, Staff Developers, Administrators

Develop Content to Reach Teens with Targeted, Online Educational Services

Shelley Miller, Kaplan, Inc. (NY), Hadley Brooks (CA), Allison Zimbalist

Room: S404a

Explore successful strategies for serving teenagers' dynamic and growing needs for educational resources on the Web through a panel discussion with executives from Kaplan Test Prep, Embark, and New York Times on the Web.

9–12, University/College; Teachers, Technology Coordinators, Staff Developers, Library/Media Specialists, Administrators

Multiple Intelligences

Weave Together Technology, Multiple Intelligences, and Patterns in Nature

Carol Lamb, Westbury School (MA), Ellen Little, Deborah Nakamura

Room: S401a

Find out how to embed technology skills as well as the eight multiple intelligences into a curriculum unit on patterns in nature.

K–12; Teachers, Technology Coordinators, Teacher Educators, Staff Developers; NETS•S: 1, 3, 4; NETS•T: iii

Laptop Learning

From Berries and Animal Skins to Cordon Bleu and Versace

Sandy Pape, Erskine Elementary School (IA)

Room: S101b

Find the answers to your questions: Why laptops? How do learning and teaching change? What are the stepping stones and stumbling blocks? Are they worth the extra effort?

4–8; Teachers, Teacher Educators, Administrators

PAPERS

Two papers per one-hour session.

Educational Technology Professional Development Program

Karen Ivers, California State University–Fullerton, Beverly Young

Room: S504a

Review the effects of intensive K–12 staff development projects on the use of technology in the K–12 classroom.

General; Teachers, Technology Coordinators, Staff Developers; NETS•T: i–iii

Staff Development Ideas from Arizona Classrooms of Tomorrow Today Program

Keith Wetzel, Arizona State University West, Ron Zambo, Ray Buss, Helen Padgett

Room: S504a

Learn about a staff development program effective in equipping K–8 teachers to integrate technology. Watch videos from exemplary classrooms and see staff development strategies.

General; Technology Coordinators, Teacher Educators, Staff Developers

MONDAY, 1–3 PM

CEO FORUM

McCormick Place, General Session Hall B1

See page 3

MONDAY, 12:30–1:30 PM

★ SPOTLIGHT SESSIONS

Teach Real-World Skills in a Multi-user Virtual Environment

Chris Dede, Harvard Graduate School of Education (MA), Karin Ruess (VA)

Room: S106a

Kids are fascinated by video games. To empower motivation and learning, our middle school science students become avatars using digitized museum artifacts in shared virtual contexts.

6–12, University/College, Community College; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators; NETS•S: 1–6; NETS•T: i–vi

Generation YES—The Center for Student-Centered Reform

Dennis Harper, Generation YES (WA), Sunny Cabrera

Room: S104

Generation YES offers four programs each solving a technology problem that all schools face: professional development, student leadership/community service, caring for infrastructure, and gender equity.

General; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators

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MONDAY, 12:30–1:30 PM, CONTINUED

SPOTLIGHT SESSIONS, CONTINUED

Kicking, Dragging, and Screaming

Glenn "Max" McGee, Illinois State Board of Education

Room: Vista Ballroom ([illegible])

Explore how tech-wise teachers, tech directors, and principals can and must lead their colleagues, kids, and communities into the new millennium. Learn how technology can be used to lead innovative standards-based instructional practices and improvement initiatives at the classroom, school, and district levels.

K–12; Teachers, Library/Media Specialists, Technology Coordinators, Administrators

Unwiring the Classroom

Jamie McKenzie, From Now On—The Educational Technology Journal *(WA)*

Room: Vista Ballroom (S406a)

With the arrival of wireless notebook computers that can travel in flotillas from classroom to classroom, schools will no longer suffer from thinly distributed computing resources.

General; Teachers, Library/Media Specialists, Technology Coordinators, Administrators

Global SchoolNet Shared Learning Teacher Award

Al Rogers, Global SchoolNet Foundation (CA), Yvonne Andres

Room: S100b/c

The Global SchoolNet (GSN) Foundation is pleased to announce the inauguration of the GSN Shared Learning Teacher Award program. This session will fully describe the program and give the first awards to some very deserving and noteworthy teachers.

K–12; Teachers, Technology Coordinators, Staff Developers, Library/Media Specialists, Administrators

CONCURRENT SESSIONS

BUILDING A FRAMEWORK

Take Total Cost of Ownership to the Classroom

Sara Fitzgerald, Consortium for School Networking (VA)

Room: [illegible]

School leaders, learn to understand and plan for all of the costs involved with operating and maintaining networked computers efficiently and effectively. (Sponsored by CoSN)

General; Technology Coordinators, Administrators

Develop International Teachers' Conferences through Community Partnerships

Mary Jo Hilbert, Phoenix Union High School District (AZ), Lorine Ely, Cathy Bollman, Nancy Hess, Talbot Bielefeldt

Room: S102b

Learn to mobilize your school districts, community organizations, and local colleges to create an international teacher's technology conference in your community.

General; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Administrators

BUILDING TECHNOLOGY CAPACITY

Get Wired! Create an Integrated Learning Environment with ASP Technology

Carol Kuczynski, Buffalo Independent Secondary Schools Network (NY)

Room: S103d

How do you offer students and teachers more technology for less money, while using old, outdated technology? The answer lies in outsourcing and ASP technology.

General; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators

BUILDING HUMAN CAPACITY

Professional Development

New Twists to Teacher Training

Linda Dickeson, Lincoln Public Schools (NE)

Room: [illegible]

Teachers want training—on their own terms! See innovative training schedules (that drop training right into teachers' laps!) and a resource-rich Web site for handouts.

General; Technology Coordinators, Staff Developers, Administrators; NETS•T: i, iii, v

Teachers' Learning During Curriculum-Based Online Projects

Judi Harris, University of Texas–Austin, Neal Grandgenett (NE)

Room: S106a

What do teachers learn as they help their students learn online? How can we collaboratively document and amplify this "authentic professional development?" Hear recent research results.

General; Teachers, Technology Coordinators, Staff Developers, Administrators; NETS•T: v

Preservice Teacher Preparation

Use an Electronic Portfolio in Special Education Teacher Preparation

Leah Herner, California Lutheran University (CA), Silva Karayan

Room: S504a

The electronic portfolio is a tool for assessment, communication, and a display of mastery of specific competencies needed to fulfill graduation requirements.

University/College, Community College; Technology Coordinators, Teacher Educators; NETS•S: 1–6; NETS•T: i–vi

Build Institutional Collaborations for Technology Integration

Heath Harding, Kansas State University, Sue Maes, Terrel Rau

Room: [illegible]

The preparation of preservice teachers takes collaborative efforts throughout each student's career. This presentation shows how one college went about creating these efforts.

University/College, Community College; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Administrators

Leadership and Competencies, Standards, and Certification

Access the Hidden Web: Find What the Search Engines Don't

Marcia Mardis, Merit Network, Inc. (MI)

Room: [illegible]

Even the savviest searcher can access only a fraction of the information available on the Web with traditional search engines. Learn tools and techniques for "deep Web" searching.

6–12, University/College, Community College; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists

A Richer Picture: Digital Portfolios for Students and Teachers

David Niguidula, Ideas Consulting (RI)

Room: [illegible]

Learn how to create and assess digital portfolios of student and teacher work, and find out how the Web can connect this work to your school's standards.

General; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Administrators; NETS•T: iv, v

If I Could Make a School

Marilyn Piper, Olympia School District (WA), Emily McCartan, Jeff Carter, Nicole Mohole

Room: [illegible]

Participants from ISTE's Student Technology Leadership Symposium will share their presentations. Student perspectives on educational technology practices and new models for learning will be discussed.

General; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators

BUILDING A LEARNING ENVIRONMENT

Early Childhood/Elementary

Use Technology in Early Childhood Environments to Strengthen Cultural Connections

Mikki Meadows, Eastern Illinois University, Frances Murphy

Room: [illegible]

Examine unique examples of technology use with young children for the development of activities that enhance relationships between families, children, and communities and facilitate cultural connections.

4–8, University/College, Community College; Teachers, Teacher Educators

Math/Science

Fifth Graders "Excel" at Spending $1 Million

Dolores Brzycki, Indiana University of Pennsylvania, Jodi Hackman

Room: [illegible]

Learn how fifth graders, teachers, and student teachers applied mathematics concepts and developed million-dollar budgets in spreadsheets and communicated the results in PowerPoint®.

4–6, University/College; Teachers, Technology Coordinators, Teacher Educators, Staff Developers

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Real-World Connections through Videoconferencing—We're Closer Than You Think!

Ruth Petersen, NASA Glenn Research Center (OH)

Room: S102b/c

Use the Internet and videoconferencing to tour a NASA® research facility, discuss research in aeronautics or space exploration with a NASA scientist/engineer, and connect science/math students to real-world researchers through problem-solving activities.

General; Teachers, Teacher Educators, Librarian/Media Specialists, Technology Coordinators, Administrators, Staff Developers; NETS•S: 3, 4–6; NETS•T: i–v

Computer Science

Build an Information Technology Specialty Program in Your High School

Chuck Drake, Forest Park High School (VA), Brian Hackett

Room: [illegible]

See how your high school can offer a state-of-the-art professional certification elective information technology (IT) curriculum.

9–12; Teachers, Technology Coordinators, Administrators

How Many Ice Cream Scoopers Are Needed?

Charlie Shub, University of Colorado–Colorado Springs

Room: [illegible]

Develop a working simulation model of an ice cream parlor. (Sponsored by the Society For Computer Simulation)

General; Teachers

Other Subjects

Searching for Alvin Toffler: Future Studies in the Classroom

Seth Itzkan, Planet-TECH Associates (MA), Sandy Burchsted (TX), Cole Jackson (FL)

Room: S301b/c

Future Studies is an emerging discipline with important application in today's classroom. Its methodologies, such as trend analysis and scenario construction, are powerful and creative.

General; Teachers, Technology Coordinators, Library/Media Specialists, Administrators

Teach Photography with 35mm Cameras and Computers

Leslie Mcgaey, Mandeville High School (LA), Sandy Scott

Room: [illegible]

Dust off those old 35 mm cameras! Using a film negative scanner, computers, Photoshop®, and an inkjet printer, you can have your own darkroom—with lights.

6–12, Community College; Teachers, Technology Coordinators, Staff Developers, Library/Media Specialists

Multimedia/Virtual Reality

The Digital Safari: Using Integrated Academics to Teach Multimedia Production

Ted Maddock, Mt. Diablo High School (CA)

Room: S102a

Find out about the Digital Safari, a multimedia academy where four teachers and 114 students work in a project-based, collaborative environment on academic projects.

9–12; Teachers, Technology Coordinators, Teacher Educators; Administrators; NETS•S: 1–6; NETS•T: i–vi

Technology Integration

Intel® Teach to the Future: A Model Teacher Development Initiative

Paige Kuni, Intel (OR); Ron LeMar (CA), Michelle Lokelly-Firth (CA)

Room: [illegible]

The Intel Teach to the Future program is designed to address the challenges teachers face in effectively applying computer technology to enhance student learning. *(Exhibitor presentation)*

General; Teachers, Teacher Educators, Library/Media Specialists, Administrators; NETS•T: i–vi

Use Technology to Make Learning Fun

Emily Smith, Teacher Created Materials (CA), Corinne Burton

Room: S402

Meet standards and keep students interested! Learn about content-driven Web hunts, virtual field trips, and Internet collaboration. Receive handouts with fun ideas using technology. *(Exhibitor presentation)*

4–8; Teachers, Technology Coordinators, Library/Media Specialists; NETS•S: 1–3

Project-Based and Problem-Based Curricula

Use of Development Teams in Problem Finding

Judith Howard, Elon University (NC)

Room: S102b/c

See how collaborative teams, including arts and sciences faculty, work with preservice teachers to develop authentic problems for technology-enhanced problem-based learning units.

University/College; Teachers, Teacher Educators, Library/Media Specialists; NETS•T: ii, iii, v

Distance/Distributed Learning

Use Videoconferencing for the "Pairing and Sharing" of Innovative Instructional Experiences

Jane Ramundine, Bunker Hill Middle School (NJ), Gail Epifanio

Booth: [illegible]

Using distance learning technologies, students and teachers paired, to share instructional experiences with the goals of improving student communication skills and building staff development opportunities.

General; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators; NETS•S: 4; NETS•T: i–iii

Laptop Learning

Change Is Ubiquitous: Models for Laptop Learning

Meghan McDermott, EDC/Center for Children and Technology (NY), Saul Rockman (CA), Kenneth Stevenson (SC), Daniel Light

Room: S101b

Schools are increasingly integrating laptops into teaching and learning. What does this mean? Drawing from research, this panel presents differing approaches, program designs, and outcomes.

General; Teachers, Technology Coordinators, Staff Developers, Library/Media Specialists, Administrators

PAPERS

Two papers per one-hour session.

Constructionism as a High-Tech Intervention Strategy for At-Risk Learners

Gary Stager, The University of Melbourne and The Seymour Papert Institute (CA)

Room: S304a

Since September 1999, the presenter has worked with Seymour Papert to develop a high-tech alternative learning environment inside the Maine Youth Center, the state facility for adjudicated teens.

9–12; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Administrators

Building Positive Attitudes Among Geographically Diverse Students: Project I-57's Experience

Paul Sandberg, University of Illinois–Urbana-Champaign

Room: S304a

See results from a collaborative Web-based project among schools in three regions of Illinois with implications for technology's potential to change student attitudes toward diversity.

6–12; Teachers, Staff Developers, Administrators

MONDAY, 1:30–3:30 PM

STUDENT SHOWCASE

All Showcases take place in the Vista Ballroom Lobby.

Donovan's Word Jar Comes to Life

Gail Bohnenstiehl, Crete Elementary (IL)

Table 3 & 4

Third-grade students will present computer-generated projects they produced after reading *Donovan's Word Jar*. They used PowerPoint®, Internet research, and desktop publishing.

K–3; Teachers, Technology Coordinators, Staff Developers

Stories from the Trenches!

Heather Chilton, Tool Factory, Inc. (VT)

Table 2

Elementary students show projects they created using various multimedia tools. Hear the stories from the trenches and gain insights on how to structure effective technology projects.

K–6; Technology Coordinators, Staff Developers, Teachers, Teacher Educators, Library/Media Specialists

Life after High School: A High-School Multimedia Project

Diane Porter, High School for the Teaching Professions (OH), Melissa Sherman

Table 1

High school juniors participate in a project focused on their post-secondary plans. Technology is infused throughout the project, which culminates in a public multimedia presentation.

9–12; Teachers, Technology Coordinators, Staff Developers

NETSchools Constellation: Reaching for the Stars and Achieving!

Tony Simons, Key Largo School (FL), Linda White

Table 5

The constellation in my classroom includes hardware, software, ongoing support, and professional development that empowers and enables my students to reach their goals.

4–8; Teachers, Technology Coordinators, Teacher Educators, Administrators

MONDAY, 1:30–3:30 PM CONTINUED

POSTERS
All posters take place in Room S401a.

Imagination Place! Kids Using the Internet for Design and Invention
Dorothy Bennett, EDC/Center for Children and Technology (NY), Terri Meade, Naomi Hupert, Shannon Jack, Cornelia Brunner, Peter Maggs (Adobe)
Table 9
See how Imagination Place!, an Internet-based design environment, can help children express their invention ideas and enhance their understanding of the built environment.
K–8; Teachers, Teacher Educators, Library/Media Specialists

Constructing Knowledge across a Network
Frances Coleman, Department of Energy (DC)
Table 7
Rural Mississippi high school students taking a variety of subjects use Knowledge Forum to enhance learning by building knowledge and community across schools and time.
General; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Administrators; NETS•S: 2–3; NETS•T: ii, iii, vi

Spinning Your Web Classroom: Innovative Online Courses
Mary Delgado, Milwaukee Public Schools (WI), Linda Kraft
Table 10
View innovative online courses created by K–12 teachers for their students and staff development. Experience how online learning can enhance your students' learning.
4–12, University/College, Community College; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators

Integrating Technology in Your Classroom: Books That Teach
Christine Flood, Milwaukee Public Schools (WI), Sara Kramer
Table 4
Integrate PowerPoint® technology into an ESL classroom. Students create Books That Teach using PowerPoint while improving English acquisition.
General; Teachers, Technology Coordinators, Teacher Educators, Administrators; NETS•S: 3; NETS•T: i–vi

It Takes More Than Technology to Make a School Successful
James Garrett, SEIRTEC/SERVE, Inc. (MS)
Table 3
Explore different educational models used by successful schools that have increased student achievement and morale. Learn how technology integration contributes to these successes. Find out how you can change your district, too.
General; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators

Personal Art Galleries: Encourage Cultural Awareness through Art and Technology
Andrea Tucker Mansfield, Beaty Eagle Middle School (MD), Becky Hutchins Napoli
Table 6
Watch students experience and evaluate the world's greatest art treasures. Building personal art galleries encourages critical thinking, development of technical Web skills, and cultural appreciation.
General; Teachers, Staff Developers, Library/Media Specialists; NETS•S: 1–3; NETS•T: ii, iii, v

Integrate Technology and Multicultural Study of the Santa Fe Trail
Pamela Najdowski, Pinon Elementary (NM), Sam Estrada, Eileen Stephens
Table 5
Fifth-grade teachers from Santa Fe, New Mexico, will share their students' application of technology in their study of the Santa Fe Trail from a local perspective.
4–8; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators

Palm Computers: Teaching Applications and Professional Development
Anne Nims, Center for Learning Technologies, CNY Regional Information Center, OCM BOCES (NY), Jim Kohl
Table 2
Palms aren't just organizers. Use yours to read books, take notes, clip Web pages, edit and print desktop documents, view maps and photos, create spreadsheets, build databases, and "beam" files!
K–12; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators; NETS•S: 1–6; NETS•T: i–v

Enhancing Learning with Visual Representation
Margaret Rice, University of Alabama, Elizabeth Wilson, M. Keith Rice, Vivian Wright, Keith George
Table 1
Learn how visual representation can aid your students' learning and how you can create visual learning activities using Inspiration® software.
6–12, University/College, Community College; Teachers, Teacher Educators

Counting on Kids: Resolving Native American Issues and Community Needs
Sandra Vogel, Ka'ahumanu Elementary (HI), Lisa Kumashiro, Denise Nakamura, Tim Yasui
Table 11
Students in Hawaii collaborate with Native American students on the mainland to research and initiate steps toward resolving common social issues plaguing both indigenous groups today. This project empowers future leaders.
General; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators; NETS•S: 1–6; NETS•T: i–vi

Facilitate Online Dialogue to Focus and Deepen Learning
Maureen Yoder, Lesley University (MA), Sarah Haavind
Table 12
Effective facilitation of online discussions can turn an online course into a truly collaborative learning community. Learn proven techniques for interventions that can enhance learning.
General; Teachers, Technology Coordinators, Teacher Educators, Staff Developers

Using a Database for Developing Lesson Plans That Meet Standards
Joseph Zisk, California University of Pennsylvania
Table 8
Let technology help you develop meaningful lesson plans that connect to national education standards. Science education lesson plans will be illustrated.
6–12, University/College; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Administrators

WEB POSTERS
All posters take place in Room S401a.

The NASA "Why?" Files: Combining Video, Print, and the Web
Heidi Boyette, NASA Langley Research Center/Virginia Beach Public Schools (VA), Jeff Seaton
Table 20
The NASA "Why?" Files series combines leading-edge technology on the Web with instructional video programming to introduce students, parents, and educators to problem-based learning.
4–6; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators

A Community of Learners: The Community Discovered Web Site
Chiara dePury, The Community Discovered (NH), Thor Allerton, Britt Clark, Robin Dwork, Neal Grandgenett
Table 21
The result of a federally funded Technology Innovation Challenge Grant, The Community Discovered Web site offers teachers and students a wealth of classroom resources.
General; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators; NETS•S: 2–6; NETS•T: i–v

Little School Funding? LaunchPad: Bringing Personal Laptops to School
Barbara MacLaughlin, Amelia Earhart Middle School (CA), Justin Whitford
Table 19
Finding little funding to make use of current technology? Consider LaunchPad, a pilot program that uses student-owned computers in the classroom.
6–12; Teachers, Technology Coordinators, Administrators

Developing Vocabulary and Critical Thinking Skills Using Web-Based Tools
H. Ogden Morse, Jr., Lyceum Communications LLC (ME), Brett McMillan (ME), Carol Abreu (PL)
Table 18
Learn how critical thinking, etymology, and engaging multimedia team up to make vocabulary acquisition and reading comprehension effective, fun, and accessible on the Web!
4–12, University/College, Community College; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators; NETS•S: 3

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Entrepreneurship Education: Living the Life of an Entrepreneur

Ken Nunn, MediaSpark IT Solutions, Inc. (NS), Mathew Geoghan

Table 10

GoVenture® Live the Life of an Entrepreneur is built around an award-winning, interactive business CD-ROM simulation, a wealth of online tools, and content on the GoVenture NETwork.

9–12, University/College, Community College; Teachers, Technology Coordinators, Staff Developers, Administrators

The Changing Role of Distance Education

John Pam, Western Illinois University

Table 37

Western Illinois University presents the changing role of distance education via satellite and the Web for student enhancement and teacher professional development.

General; Teachers, Technology Coordinators, Staff Developers, Library/Media Specialists

Steps to Success: Creating Great Science Fair Projects

Gloria Pagsfidy, Norwood Park School (IL)

Table 22

Learn how Grade 7 and 8 students at Jordan Community and Norwood Park Schools use Internet resources, activities, and communication tools to create meaningful science fair projects.

6–8; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators

Development and Application of CHaTNet, an Intranet Campus Network

Hidenori Shinken, Tamagawa University (Japan), Kando Brigachi

Table 23

Explore a new educational method using CHaTNet (Children, Homes, and Teachers Network) system, created by one Japanese private K–12 school.

K–12; Teachers

An Online Course to Develop Online Courses

Stan Silverman, New York Institute of Technology, Gene Silverman, Marilyn Barile

Table 24

In this Web session, gain the strategies to develop online courses for teachers, students, and administrators in PK–16 schools and universities.

General; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators

The Math Forum: An Online Resource for Teachers and Students

Judy Underwood, WebCT/The Math Forum (PA), Sheldon Berman

Table 19

Learn about The Math Forum, one of the most popular online sites for mathematics education, including Ask Dr. Math, Problems of the Week, and Teacher2Teacher.

General; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators

Experience How Oak Terrace Elementary Integrates Technology into its Curriculum

Kathy Weiger, Oak Terrace Elementary School (IL), Doreen Odinger-Johnson, Genevieve Karlen, Susan Stillman

Table 14

Our Web site is full of resources for parents, students, and teachers. Imagine the ease of engaging in projects that use Web sites researched before students' use.

K–6; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators; NETS•S: 1–5

Bringing the World to Classrooms: New York Times Learning Network

Alison Zimbalist, The New York Times Learning Network

Table 13

The Learning Network offers daily lessons, interactive quizzes, puzzles, top stories, and much more to bring today's Times to your students free!

3–12, University/College; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators

MONDAY, 2–3 PM

★ SPOTLIGHT SESSIONS

Web-Based Learning: America's Educators Speak to Congress

Larry Anderson, National Center for Technology Planning (MS), Bob Kerrey (DC), Patti Abraham (MS), Florence McGinn (NJ), Richard Green (SD), Kathleen Fulton (DC), John Vaille (OR)

Room: Vista Ballroom (2400b)

Members of the U.S. Web-Based Education Commission, along with selected individuals who provided testimony, discuss details of their recent report to Congress.

General; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators

Prepare Teachers to Use Modeling and Visualization in Science and Mathematics

Lisa Bievenue, NCSA, University of Illinois, Sharon Derry (PT), Margie Linn (CA), Mary Ellen Verona (MD)

Room: 2001a.

Attend this report from the Workshop to Integrate Computer-Based Modeling and Scientific Visualization into K–12 Teacher Education Programs (October 2000), co-funded by NSF and PT³.

9–12, University/College, Community College; Teacher Educators, Staff Developers, Administrators; NETS•S: 5, 6

Captured Wisdom: A Dialogue about Best Practices in the Use of Technology for Teaching and Learning

Kristin Clemmer, North Central Regional Technology in Education Consortium (IL), Mary Clifford

Room: 3105

The North Central Regional Technology in Education Consortium (NCR*TEC) continues to develop "Captured Wisdom" series featuring practices that inform the effective use of technology. Join the conversation to inform the future production of these visual tools for professional development and technical assistance.

General; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators

Palm-Sized Computers in K–12: Experiences from the Field

Elliot Soloway, University of Michigan, Cathleen Norris (TX), Rich Mitchell (IL), Bob Tinker (MA)

Room: Vista Ballroom (2400a)

There are many great reasons palm-sized computers can and will play a key role in K–12 education. The presenters in this panel session will describe the innovative educational uses that palm-sized computers are playing in their schools.

General; Teachers, Teacher Educators, Library/Media Specialists, Technology Coordinators, Administrators, Staff Developers

Grappling with Bytes and Blinking Lights: Identifying Capacity for Technology

Julie Parra, Compaq Computer Corporation (TX)

Room: 3104

This Spotlight will help identify effective practice, training and funding strategies for classroom integration, and administrative technology implementation. (Sponsored by Compaq)

General; Technology Coordinators, Administrators, Staff Developers

BUILDING A FRAMEWORK

Cut Technology Costs through Standards and Audits

Daryl Ann Borel, Houston Independent School District (TX), Nancy Burkhart

Room: 3100d

See how adopting standards for hardware, software, and network components—combined with site-based audits can reduce overall technology costs.

General; Technology Coordinators, Administrators

Learning Tomorrow's Way Today: Beyond Technology Integration

David Pilsbell, Woodcrest College (Queensland, Australia)

Room: 3102a

Find out how Woodcrest College has made technology a routine part of the school day across the whole college through curriculum reform, innovative design, and sound philosophy.

K–12; Teachers, Technology Coordinators, Staff Developers, Administrators; NETS•S: 1–6

BUILDING TECHNOLOGY CAPACITY

Computer, Heal Thyself! Version 2: The Technology Umbrella Theory

Michael Hesse, Hesse DSO/DoDDS Europe (Germany), Martin Applegate, Tom Perry

Room: 2402

Inspired by the NECC 2000 presentation, this all-new, down-to-earth session offers end users a rational approach to flawless technology operation. A very practical session!

K–12, University/College, Community College; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators

BUILDING HUMAN CAPACITY

Professional Development

Project MEET (Massachusetts Empowering Educators with Technology)

Joan Champa, Massachusetts Department of Education, Paula Moran, Irene Vance, Erica Levy

Room: 3100b

Project MEET is a five-year technology professional development project focused on improving all students' learning. It uses a three-tiered approach: teaching, support, and policy.

General; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators; NETS•S: 1–6; NETS•T: I–VI

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MONDAY, 2–3 PM CONTINUED

Professional Development, Continued

Replicable Schools: A Model Technology Infusion Program in the Milwaukee Public Schools

Mel Hyneh, Milwaukee Public Schools (WI), Ada Rivera, Kathy Gambaletta, Diane Rzonski

Room: [illegible]

Learn about a highly effective model technology program that accelerates the implementation of technology in schools. See an Internet-based application for teachers to share effective standards-based instructional plans across the district.

9K–12, University/College; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Administrators

Technology Best Practice through Staff Self-Assessment

Bob Moore, Blue Valley Schools (KS), Blake West, Carol Bartolay

Room: [illegible]

Mix ISTE standards, teacher evaluation, and district staff development requirements. What do you get? A tool for helping teachers grow and districts plan effectively!

General; Technology Coordinators, Staff Developers, Administrators; NETS•[illegible]

Preservice Teacher Preparation

Technology Integration in Preservice Field Experiences: A University–District Partnership

Matthew Barritt, Pacific Lutheran University (WA), George Langfeldt

Room: [illegible]

Find out about a university–school district partnership that provides preservice teachers with experience supporting technology integration and simultaneously supports the district's technology integration process.

K–12, University/College; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Administrators; NETS•T: I–III, VI

Technology: A Great Enhancement for Today's Student Leader

Anne Hillman, Mississippi State University, Richard Blackburn, Chad Gober, Rob Dunnam

Room: [illegible]

This session is designed to illustrate the importance of technology skills in today's student leaders. Your students' leadership advancement is only a click away.

9–12, University/College, Community College; Teachers, Technology Coordinators

Leadership and Competencies, Standards, and Certification

Develop and Maintain Elementary Web Sites with Junior Web Masters

Linda Hagen, Drake University (IA), Joanne Van Gundren, Ann Wiley

Room: [illegible]

Here's a program that brings together teams of fifth-grade students and a teacher/sponsor to create a dynamic Web presence for elementary schools in two districts.

General; Teachers, Technology Coordinators, Staff Developers, Library/Media Specialists, Administrators

BUILDING A LEARNING ENVIRONMENT

Early Childhood/ Elementary

Technology: A Tool for Today's Early Learners

Dora Feldman, PowerUP (MD)

Room: [illegible]

Explore how technology can enhance the learning of young children! Quality digital content and tools will be highlighted as developmentally appropriate best practices are modeled.

K–3; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators; NETS•S: 1–6; NETS•T: I–VI

Language Arts/ Social Studies

A Renaissance through Technology: Developing a Schoolwide Theme

Linda Babb, James F. Byrnes High School (SC), Jo Lynn Allen, Paula Duncan, Judith Perkins

Room: [illegible]

A high school finds the Renaissance to be the perfect schoolwide theme and technology to be the perfect catalyst to develop that theme.

9–12; Teachers, Technology Coordinators, Teacher Educators, Library/Media Specialists, Administrators

Math/Science

Probeware: The Sport Utility Vehicle for Technology Integration in Science

Marvin Hoegh, Idaho State University, Roger Grundy, Heidi McJunkin, Albert Strickland

Room: [illegible]

The sport and utility of probeware bridges gaps between science disciplines. See the intersections between textbooks, science curriculum, and probeware during this multimedia presentation using databases. Leave with handouts.

4–12; Teachers, Technology Coordinators, Staff Developers, Administrators

Algebra I for the MTV Generation

Virginia Jewell, Clarke County School District (GA)

Room: [illegible]

Find out about a three-year project that uses broadcast television, Web materials, and laptop computers to make Algebra I an engaging and successful experience for today's students.

9–12; Teachers, Administrators

Integrate Technology to Enhance the Teaching of Science

Dorothy Forum, National Geographic Society (DC)

Room: [illegible]

Explore a multitude of cross-curricular activities appropriate for students in Grades 3–9 that use technology to tie science to math, language arts, reading, and social studies. *(Exhibitor presentation)*

4–8; Teachers, Technology Coordinators, Library/Media Specialists

Solve Multimedia Problems in Middle School Mathematics with Computer-Based Tools

Catherine Yobe, SRI International (VA), Andrew Zucker

Room: [illegible]

Middle school mathematics programs can be strengthened by MathLab software, which combines powerful computer-based tools (such as spreadsheets) and engaging multimedia problems in a problem-solving environment.

6–8; Teachers, Technology Coordinators, Teacher Educators

Computer Science

Two Techniques for Teaching Computer Programming

Philip East, University of Northern Iowa

Room: [illegible]

I still hate grading! To reduce that burden, I have students assess the quality of their own programs and use in-person grading of projects. Find out how this system can work for you.

9–12, University/College, Community College; Teachers

Other Subjects

A Sound Approach: Using Music in the Classroom

Lee Fournier, Thornburg Center for Professional Development (CA), Lyndl Barmark

Room: [illegible]

Discover the power of music and the compelling need for it in the classroom. Learn to use simple musical resources to enthrall every learner.

General; Teachers

Multimedia/ Virtual Reality

Top 10 Ways to Make PowerPoint® an Educational Tool

Donna Dierdorff, Belle Valley School District (IL), Sue Miller

Room: [illegible]

Learn new easy-to-use ideas that your students will embrace. You are guaranteed to go home with new enthusiasm for PowerPoint. Get lots of ideas and leave with handouts.

General; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators; NETS•S: 1, 3–5; NETS•T: I–VI

Technology Integration

Curriculum and Technology: Connections by Design

Elizabeth Hofmann, The Linsly School (WV)

Room: [illegible]

A curriculum review is the perfect vehicle to map out where the technology fits and where it does not.

General; Teachers, Technology Coordinators, Staff Developers, Administrators

Project-Based and Problem-Based Curricula and Cooperative/ Collaborative Learning

Why Use the Internet? Projects That Are Worth the Trouble

Stefanie Hausman, Co-nect (MA)

Room: [illegible]

Review four identified best practices and see specific project examples of what makes the Internet a worthwhile teaching and learning tool for project-based learning. *(Exhibitor presentation)*

General; Teachers, Technology Coordinators, Staff Developers, Administrators

Wired Together: Using the Internet for Collaboration

Gail Lovely, Classroom Connect (CA)

Room: [illegible]

Many people think of the Internet as a big library. Learn to look at the Internet as a vast range of collaborative opportunities. Find out about group work, data sharing, projects with peers and experts, and more.

K–12; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators

BEST COPY AVAILABLE

Student Assessment

Digital Video Strategies for Authentic Assessment

Kathryn Morgan, Bemidji State University (MN), Kathy Thygeson

Room: S100b

Digital video has a unique power to capture evidence of the teaching and learning process and support teacher and student assessment of achievement.

General; Teachers, Teacher Educators, Staff Developers, Administrators

BUILDING EQUITY AND ACCOUNTABILITY

Stop the Madness: Use the Web to Bring Accountability to Standardized Testing

Linda Polin, Pepperdine University Graduate School of Education and Psychology (CA), Gary Stager, Susan Ohanian (VT), David Thornburg (IL), George Schmidt (IL)

Room: S100a

A new Web site will be inaugurated at NECC 2001 dedicated to assisting parents and teachers in stopping the testing madness and diverting those funds to a variety of significantly more productive ends in school.

General; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators

PAPERS

Two papers per one-hour session.

Simulations in the Learning Cycle: A Case Study

William Deaton, University of Alabama, Velma Lopez

Room: S504a

This case study provides an example of the effective use of simulations in learning-cycle lessons for middle school students engaged in environmental studies.

6–8, University/College; Teachers, Teacher Educators; NETS•S: 3, 5, 6; NETS•T: ii, iii

Web-Based, Computer-Supported Cooperative Work: A PT³ Case Study

John McEneaney, Oakland University (MI), Wendy Sobrin, Ledong Li, Hema Rishamani

Room: S504a

Explore a school–university partnership that applies Web technologies and computer-supported cooperative work (CSCW) principles to create a PT³ project management system.

General; Technology Coordinators, Teacher Educators, Staff Developers, Administrators

MONDAY, 3:30–4:30 PM

SPOTLIGHT SESSIONS

CUIP: A University/Public Schools Partnership Supporting Technology in Local Schools

Craig Cunningham, Chicago Public Schools/University of Chicago Internet Project (IL), Bea Lamb, Simion Vélez, Karo Rosen, Julie Bern, Christa Thomas

Room: S106b

Learn about the history, progress, and diverse programs of a unique partnership between the University of Chicago and the Chicago Public Schools to support technology in schools in the university neighborhood.

General; Technology Coordinators, Staff Developers, Library/Media Specialists, Administrators

Metacourses™ for Online Professional Development

Sherry Hsi, Metacourses (CA), Sarah Haavind (MA), Maureen Yoder (MA)

Room: S106a

Metacourses are online seminars that teach best practices in eTeaching, pedagogy, and group work. Pose questions to experts about their approaches to online professional development.

9–12, University/College, Community College; Teachers, Teacher Educators, Staff Developers

Getting It Right: Aligning Technology Initiatives for Measurable Student Results

Ian Jukes, The InfoSavvy Group (BC, Canada), Ted McCain

Room: S106

Learn to align technology initiatives with curriculum, state standards, staff development, and instructional goals so that technology dollars can be spent more effectively.

K–12, University/College; Teachers, Technology Coordinators, Staff Developers, Administrators

Web-Based Integrated Science Environment (WISE): Inquiry for Lifelong Learning

Marcia Linn, University of California–Berkeley, James Slotta

Room: Vista Ballroom (S406b)

WISE engages students in complex scientific inquiries (e.g., deformed frogs, how far does light go, genetically modified foods), fostering lifelong learning and teacher professional development.

4–12, Community College; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators

Beware the Wizard

Jamie McKenzie, From Now On—The Educational Technology Journal (WA)

Room: Vista Ballroom (S406a)

In our zeal to make powerful use of new technologies, we have sometimes forgotten the strategies used to show students the difference between quality work and imitative work.

K–12; Teachers, Teacher Educators, Library/Media Specialists

Will You Have a Job in 2010?

Art Wolinsky, Online Internet Institute (NJ), Ferdi Serim (NM)

Room: S101a

By 2003, eLearing will be an $11 billion business. Will you be working in school or a corporate eLearning center?

K–12, University/College, Community College; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators

BUILDING A FRAMEWORK

CARET: Center for Applied Research in Educational Technology

John Cradler, Educational Support Systems (CA), Ruthmary Cradler, Talbot Bielefeldt (OR)

Room: S102a

The Gates Foundation funded CARET with ISTE and ESS to bring user-friendly reports of research to assist educators in planning for educational technology at the school, district, or state level. (Sponsored by ISTE)

General; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators

BUILDING TECHNOLOGY CAPACITY

Use Technology to Improve Outcomes for All Students

Libby Cohen, University of Southern Maine, Deb Dimmick, Doug Kahill

Room: S100b/c

See assistive technology in action, and learn techniques for including all, students in the regular education curriculum!

K–12, University/College, Community College; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators; NETS•S: 1–3, 6; NETS•T: i–vi

Show Me the Money!

Terry Landers, disABILITY Resources (MT)

Room: S402a

How do you plan for the technology needs of students with disabilities, and where is the money to acquire what is needed?

K–12; Administrators

BUILDING HUMAN CAPACITY

Professional Development

Tantalize Timid Teachers with Technology

Marty Daniel, Rice University (TX)

Room: S403b

Captivate the non–technology-using teacher with a variety of irresistible strategies to facilitate focused student projects and enriched community involvement. All of these resources require minimum prior computer experience.

General; Teacher Educators, Library/Media Specialists, Technology Coordinators, Administrators, Staff Developers

Preservice Teacher Preparation

Implementing ISTE's NETS for Teachers: What Might It Look Like?

M.G. (Peggy) Kelly, ISTE NETS Project (CA)

Room: S501d

Following the success of ISTE's NETS for Students guide *Connecting Curriculum and Technology*, NECC 2001 marks the release of the companion volume to NETS for Teachers. (Sponsored by ISTE)

General; Teachers, Technology Coordinators, Teacher Educators, Staff Developers; NETS•S: 1–6; NETS•T: i–vi

Effective Cohort Development for Engaging Technology Integration by University Faculty

Steven Smith, University of Kansas, Rae Ann, Joe O'Brien, Suzanne Robinson, Sara Smith, Brian Newberry

Room: S501c

Learn how one university brings together its faculty, students, and K–12 partners to develop innovative ways to integrate technology into a teacher education program.

University/College, Community College; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists

MONDAY, 3:30–4:30 PM CONTINUED

BUILDING A LEARNING ENVIRONMENT

Early Childhood/ Elementary

I Teach Primary—What Software Should I Use?

Martha Lifter, California Polytechnic University

Room: S404b/c

There is a myriad of software on the market today, how do I find programs that are appropriate for young children? Find out!

K–3; Teachers, Technology Coordinators, Teacher Educators, Staff Developers

Language Arts/ Social Studies

Engage Your Students in Roadtrip America

Donna Archibald, Aurora School District #37 (IL), Nancy Johnson, Eileen Hall

Room: S402

Want to get your students excited? Learn how your third through fifth graders can participate in a virtual trip through the regions of the United States.

K–6; Teachers, Technology Coordinators, Teacher Educators, Staff Developers

Math/Science

InterMath: Professional and Cognitive Development through Problem Solving with Technology

Evan Glazer, University of Georgia, Amy Hackenberg

Room: S[illegible]

InterMath builds a community of teachers through technology-enhanced investigations that deepen teachers' understanding of mathematical concepts related to middle school curricula.

6–8, University/College; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Administrators

SMETE Digital Library: Possibilities, Promise, and Progress

Ellen Hoffman, Eastern Michigan University/Merit Network, Inc., Martin Morello, Kate Pittsley

Room: S404d

Merit Network and Eastern Michigan University, NSDL grantees, discuss the challenges this large-scale NSF project faces as well as its exciting opportunities and resources for science educators and students.

K–12, University/College, Community College; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators

Integrating Science and Technology from the American Museum of Natural History

Francine Millman, American Museum of Natural History (NY), Nancy Hechinger, Caroline Nobel

Room: S[illegible]

See an overview of innovative new technology projects that connect people of all ages to real science and real scientists.

General; Teachers, Staff Developers

SMARTworks Robotics Camp: The Value of Robotics in the Learning

Timothy Phillips, Bloomsburg University (PA), Mike Phillips

Room: S103b/c

SMARTworks provides teachers and students with experiences in building/programming robotics. Robotics provides experiences in sciences, mathematics, and team building. LEGO Mindstorms could be implemented in any school.

4–12, University/College, Community College; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Administrators

Computer Science

CyberCareers Project Update: Diversity in IT Careers

Allen Parrish, The University of Alabama, Peter Safford (WA)

Room: S[illegible]

There are careers in IT for everyone! The CyberCareers project promotes the diversity of available IT careers through a video and an interactive Web site. (Sponsored by the IEEE Computer Society)

6–12; Teachers, Library/Media Specialists

Special Populations

Assistive Technology and Independence in the General Education Setting

Dana Chilton, Winthrop University (SC), Lisa Harris, Rebecca Evers

Room: S404a

Find out how teachers can use technology to support learning for all students while providing those with learning disabilities the extra support they need.

General; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators; NETS•S: 2, 3; NETS•T: ii, iii, vi

Multimedia/ Virtual Reality

The Director in the Classroom: Teaching and Learning through Video

Nikos Theodosakis, The NuSavvy Company (Canada), Ian Jukes

Room: S[illegible]

Filmmaker and educator Nikos Theodosakis examines exciting current and emerging approaches to engage students, enhance curriculum, and create learning adventures using video production in the classroom.

K–12; Teachers, Staff Developers, Administrators; NETS•S: 1–6; NETS•T: i–vi

Internet/Web

Internet Tools for Teachers: Create, Communicate, and Share

David Dockterman, Tom Snyder Productions (MA)

Room: S104

See easy-to-use online tools for the professional teacher that make it easier for you to manage your workload from school, home, or anywhere. (*Exhibitor presentation*)

K–12; Teachers, Technology Coordinators, Teacher Educators, Administrators

TIP-TOP Web-Based Projects

Lona Sternberg, Chicago Public Schools (IL), Kate Joseph, Heidy LaPlante, Laura Blake

Room: S[illegible]

Students engage in Web-based projects integrating math, science, social studies, language arts, art, and technology. Various projects will be demonstrated.

K–8; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators

Creating Cultural Understanding: A Videoconferencing Adventure!

Mark Trapp, IN-VISION (NE), Lisa Knudson, Julie Jakob, Kae Lacome

Room: S101b

Learn how elementary classrooms are able to use videoconferencing on the Internet to support cultural awareness and Spanish-language learning with minimal equipment or expertise!

K–8; Teachers, Technology Coordinators

Project-Based Curricula

Project-Based Learning with Geographic Information Systems

Kevin Clark, Berrien County Intermediate School District (MI)

Room: S[illegible]

Geographic information systems (GIS) connect information to location, allowing data to be easily visualized. Science and geography teachers, learn how GIS software fits problem-based learning strategies.

3–12; Teachers; NETS•S: 3, 5, 6; NETS•T: ii, iii

Literacies for the Information Age

Visual Literacy: The Basic Skill for 21st-Century Schools

Lynell Burmark, Thornburg Center for Professional Development (CA), Lee Fournier

Room: S401d

To survive in our increasingly visual society, teachers and students must learn to read (consume) and write (produce) visual images. Start your classroom canvas today!

General; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators

Research and Best Practices in Teaching and Learning

How Can a School Use Technology to Communicate with Parents?

Barbara Rountree, University of Alabama, John Durham, Mike Naturello, Lillian Rogers, Gwendolyn Sulpes

Room: S[illegible]

Panels of teachers and principals from preschools, elementary schools, and middle schools will share examples of effective communication with parents using technology.

K–8; Teachers

Building Equity and Accountability

The Interface of Technology and Literacy Development: Ethics, Pedagogy, Legalities

Martha Harrison, University of South Florida, Kate Kemker, Renee Williams

Room: S[illegible]

Teachers and university professors, view current information that affects classroom practice.

K–12, University/College, Community College; Teachers, Technology Coordinators, Teacher Educators

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PAPERS

Two papers per one-hour session.

E-pals: Examining a Cross-cultural Literature and Writing Project

Lauren McClanahan, The Ohio State University

Room: S504a

Learn what happened when a class of high school juniors in Ohio paired up with students their age in Moscow, Russia, to discuss literature on the Internet.

6–12, University/College, Community College; Teachers, Teacher Educators

Cross-Country Conversations: Techniques for Facilitating Web-Based Collaboration

Julie Reinhart, University of North Carolina–Greensboro, Tiffany Anderson, Joseph Sloczkowski (CA)

Room: S504a

Hear about the techniques used to facilitate collaboration between three university classes located in different geographic locations. Leave with new ideas for facilitating your own Web-based collaborative projects.

9–12, University/College, Community College; Teachers, Technology Coordinators, Teacher Educators

MONDAY, 5–6 PM

BIRDS-OF-A-FEATHER SESSIONS

Technology Coordinator Sharing

Barbara Allbright

Room: S101a

Teachers Together: Collaborative Reflection as Professional Development

Lynda Abbott

Room: S101b

Technology for the Terrified (Teachers Who Resist Even Trying)

Joseph Arcemont

Room: S102a

PT³ Web-Based Professional Development in Teacher Education

Doug Brooks

Room: S103b

Constructionist Learning on the Internet

Amy Bruckman

Room: S103d

Introducing Technology into the Classroom in Developing Countries

Howard Campbell

Room: S103a

Internet Textbook Publishing

Tim Collins

Room: S103b

Bluesmen of the Silicon Delta

Lee Fournier and David Thornburg

Room S401d

Networking of Catholic School Educators

Mark Gorski

Room: S105a

Technology Pioneers

Kristen Hammond

Room: S105b/c

Building Technology Leaders

Pamela Hanfland

Room: S104d

Certification Programs

Scott Horan

Room: S404a

Engaging Higher Education Faculty in Professional Development

Christine Hunt

Room: S404b/c

Software Evaluation and Classroom Testers

Judi Mathis Johnson

Room: S404d

Electronic Portfolios

David Niguidula, Helen Barrett, and Hilarie Davis

Room: S402

Library Media—Elementary and Middle School Issues

Ruth Ristow

Room: S405a

Internet Safety/Policies

Kitty Wiegel and Cheryl McCamron

Room: S405b

ESL, Spanish, and other Language Learners

Ann Bishop

Room: S501a

Middle School Units—What Cool Learning Have your Students Done?

Richard Levine

Room: S501b

WWWEDU: Web and Education Listserv

Andy Carvin

Room: S501d

TUESDAY KEYNOTE, 8:30–10 AM

GENERAL SESSION HALL B1

JANIECE WEBB & JOHN STUPKA

Touching Tomorrow Today: A Practical Look at Future Technologies

Take a firsthand look at technologies in development and what changes they may bring to education. Webb and Stupka's interactive presentation will demonstrate innovative products, profile classrooms piloting future technologies, and update you on the latest in handheld devices, wireless communications, the Internet, Bluetooth, and more. Learn how emerging technologies will empower teachers and students to simplify and personalize today's information overload. They will also discuss the ways that technology's promise will help schools, families, and businesses accomplish the goal of bridging the Digital Divide.

STUDENT SHOWCASE

TUESDAY, 10 AM–12 NOON

All Showcases take place in the Vista Ballroom Lobby.

You Want to What? Challenging Advanced Students with Authentic Projects

Elizabeth Hofmann, The Linsly School (WV), Frank Wilson, BJ Dupont, Darryl Crouse

Tables 3 & 4

Watch our students share their authentic independent study projects. Use their ideas to challenge the advanced students in and out of your classroom.

6–12; Teachers, Technology Coordinators

Is Seeing Believing? Tools for Evaluating Visual Media, Grades 5–8

Joanne Oppenheimer, Schools of the Sacred Heart (CA), Andy McKee

Table 1

Learn strategies to teach critical evaluation of images in media. See examples of student projects using video and image manipulation software.

4–8; Teachers, Technology Coordinators, Library/Media Specialists, Administrators

Using the Internet in South Africa

Ross Opperman, Hopgood High School (MA)

Tables 5 & 6

Review Internet participation by children in South Africa, with a special focus on general communication and classroom participation in the Kidlink project.

General; Teachers, Technology Coordinators, Teacher Educators

EdTechQuest: Gold Medal Multimedia Presentation Winners

Shane Wright, University of Idaho (WA), Jeff Harms (ID), Gene Tank (ID)

Table 2

The University of Idaho proudly presents the Gold Medal Multimedia presentation of elementary, middle, and high school winners from its first annual TechnOlympics.

K–12; Teachers, Technology Coordinators

POSTERS

All posters take place in Room S401a.

Multimedia Access to Curriculum Standards for Students with Special Needs

Jack Camp, Boston Public Schools (MA), Amy Goldman, Wynne Freed

Table 12

Learn how Intellitools Software technology can improve curriculum accessibility for students with special needs to help them reach IEP goals.

K–8; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists

Technology Ambassadors: Classroom-Based Technology Integration Help

Joanne Clements, New York Institute of Technology

Table 3

Learn how higher education is collaborating with K–12 schools to produce technology ambassadors. The result: experienced preservice teachers and inservice professional development. A win-win solution!

K–12, University/College; Teachers, Teacher Educators, Staff Developers, Administrators; NETS•T) II, III, v

TUESDAY, 10 AM–12 NOON, CONTINUED

POSTERS, CONTINUED

Student Reading Profile: An Innovative, Analytical Building-Based Assessment System

Richard Clift, Urbana School District #116 (IL), Linda Berry, Mary Vestil, Joan Ferrandino, [illegible], Terri Schoon

Table 9

Learn about an innovative use of technology: profiling student reading achievement to document progress, target specific needs, aid in allocating instructional resources, and improve parent-school communication and involvement.

K–6; Teachers, Technology Coordinators, Staff Developers, Administrators

Learning Technologies Facilitators/Instructional Coordinators: Building a System of Change

Brian Eldridge, Schaumburg School District 54 (IL), Katherine Mazzoli, Mary Kay Morello

Table 10

Our job-embedded staff development model fosters systemic change and emulates the engaged learning practices we want our students and lifelong learning community to experience.

K–12; Teachers, Technology Coordinators, Developers, Administrators

Fly Like a Butterfly, Sting Like a Bee!

Carol Holzberg, Swift River School (MA), Carolyn Cronan, Janet Dunham, Victoria Moore

Table 4

See highlights of our technology-rich insect curriculum (Grades 1/2) combining scientific, inquiry-based, real-world activities exploring insect life with computer-based science, reading, math, Spanish-language, and Internet activities.

K–12; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators

Professional Development in Curriculum, Technology, and Education Reform

Sandra Levin, University of Illinois–Urbana-Champaign, Jim Levin, Zandra Bishop, [illegible], Jared Brown

Table 7

You can now earn a master's degree online. Faculty, practicing teachers, and their students will be on-hand to talk about this innovative program.

General; Teachers, Technology Coordinators, Staff Developers, Library/Media Specialists, Administrators NETS•S: 1–6; NETS•T: I–vi

A Web Site of a Schoolyard Ecosystem

Velma Lopez, University of Alabama, William Draper

Table 6

Connecting technology to teaching and learning, from simulation software to a Web site on a school yard ecosystem.

4–12; Teachers, Technology Coordinators, Teacher Educators

A Taste of Technology on the Santa Fe Trail

Sandy Marick, Cheraw Consolidated Schools (CO)

Table 5

Students from a small town use technology to investigate places along the Santa Fe Trail. This poster session includes student work, digital images, and teacher-created materials.

6–8; Teachers, Technology Coordinators, Teacher Educators, Library/Media Specialists, Administrators

iCATS: Integrating Curriculum and Technology Specialists

Michael Ross, Evansville-Vanderburgh School Corporation (IN), Terry Hughes, Carol Hudson, Karen McBride, Teri Sanders, Mike Taylor, Libby Turner, Annette Lamb (TX)

Table 11

Come hear about iCATS, a new "breed" of educator combining curriculum, technology, and professional development skills to help colleagues build a technology-rich environment for learning.

K–12; Teachers, Technology Coordinators, Staff Developers, Administrators

Coming into the Digital Age of Teaching

Rita Watts, Whiteville City Schools (NC), Patricia Medlin

Table 1

Teaching in the Digital Age is like confronting a revolving door with many new choices. Bring the world into the classroom and explore the revolving door.

General; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators

Multimedia and Web-Based Tools for Students with Disabilities

Cheryl Wissick, University of South Carolina, Charles de Kloeff, Jolene Gardner (OK), Dave Edyburn (WI), Windy Schweder

Table 2

See a demonstration of multimedia and Web-based tools for technology integration, curriculum adaptation, virtual field trips, thematic units, and interactive functional activities for students with disabilities.

K–12, University/College Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Administrators

Global Connections—Products and Prospects

David Woods, Rose Tree Media School District (PA), Susan Golder, Laura Mutter (IN), Donna Wilkie (IA), Patti Linden, Peggy Lovejoy

Table 3

Global Connections is a three-year old project bringing together classes in three geographically dispersed school districts to design long-distance collaborative learning projects.

K–12; Teachers, Technology Coordinators, Staff Developers, Administrators

WEB POSTERS

All posters take place in Room S401a.

NASAexplores: Express Lessons and Online Resources for K–12 Educators

Sharon Arrington, NASA (AL)

Table 20

Discuss NASA education programs, workshops, Spacelink, NASAexplores.com, Education Resource Centers, and much more with representatives from various NASA centers and enterprises.

K–12; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists

Individualize Web Science and Math for Hispanic English Language Learners

Ann Bishop, Multilingual Ed Tech (NY), Jorge Almina (Argentina), Patricia Savenije (MA), Joanna Urrutia (FL)

Table 21

To accelerate learning of subject areas among English language learners, school systems collaborate to customize content from a K–12 Argentinean Web site to match and enhance curriculum.

K–12; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Administrators; NETS•S: 2, 3; NETS•T: ii, iii, v, vi

Profiling Dynamic Presentations of Student Projects Using the Internet

Steve Cairns, Methodist Ladies' College (Victoria, Australia)

Table 14

Discover how you can archive and keep profiles of each student's projects. Develop your pupils' collaborative, technical, Web publishing, and multimedia skills along the way.

K–8; Teachers Technology Coordinators Staff Developers

The Digital Bridges Web Site: K–12 Videoconferencing

Kirk dePord, Northwest Regional Educational Laboratory (OR), Gary Greene

Table 19

Videoconferencing technology for K–12 educators … a solution or a problem? The Digital Bridges Web site offers help in finding answers to your questions!

K–12; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators; NETS•T: i, ii

Weaving an Interdisciplinary Web: From Word Processing to Multimedia on Stage

Susan Hennings-Haff, Germantown Academy (PA), Phy Chauveau

Table 22

Explore a dynamic, kid-driven Web site rich in integrated technologies and interdisciplinary connections. From word processing to multimedia, gain the tools and inspiration to launch any class into cyberspace.

General; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists

Teach about Complexity in K–12: New Approaches to Ecosystem Education

Jennifer Karson, McGill University (QC, Canada)

Table 18

Participate in educational research! Our primary goal is to innovate technological and conceptual tools for teaching about complexity through K–12 ecosystem lessons. Thought-provoking questionnaire included!

K–12, University/College, Community College Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Administrators

Teach Entrepreneurship Education Online with BizTech
Jane Mahoney, National Foundation for Teaching Entrepreneurship (NY)

Table 15

Learn about BizTech, an Internet-based entrepreneurship program for students in Grades 7–12 and above. Students learn how to start and operate a business and write a complete business plan online.

6–12, University/College, Community College; Teachers, Technology Coordinators, Library/Media Specialists, Administrators

Cultural Connections: A Writing Project Connecting School and Community
Pamela Quebedeaux, Dalby Elementary (LA), Melissa Bushnell, Mark Hayes, Karyl O'Banion

Table 16

With a project goal of affecting performance on high-stakes testing, Cultural Connections provides authentic writing opportunities connecting Louisiana students, their community, and their culture.

K–8; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators

Problem Solving in Science through Dynamic Computer Models
Susan Ragan, Maryland Virtual High School, Mary Ellen Verona

Table 17

Use Web-based models and simulations to stimulate your students to think critically while testing hypotheses and analyzing data generated by models of authentic scientific problems.

9–12, University/College, Community College; Teachers; NETS•S: 6; NETS•T: ii, iii

The CyberClassroom: Opening Our Classrooms to the World
David Wallace, Apple Distinguished Educator Class of 2000 (KS)

Table 13

Develop your school's Web site to provide interactive writing activities, time-lapsed and streamed science projects, and curriculum-driven, teacher-created Web activities.

K–12; Teachers, Technology Coordinators

Teach the Holocaust Using Multimedia Methods
Elizabeth Wilson, University of Alabama, Margaret Rice, Mary Karyn [illegible]

Table 23

Explore the events of the Holocaust while learning how to use multimedia technology for interdisciplinary teaching.

6–12, University/College, Community College; Teachers, Teacher Educators

Online Student Testing: Use the Web for Assessment and Review
Ronald Wieting, Seward High School (NE)

Table 24

Learn about using JavaScript, online JavaScript helpers, online Web hosts, and DreamWeaver® to create review and assessment items.

6–12, University/College, Community College Teachers

TUESDAY, 10:30–11:30 AM

★ SPOTLIGHT SESSIONS

Technology-Based Learning That Works!
Edward Coughlin, The Metiri Group (CA), Cheryl Lemke

Room: Vista Ballroom ([illegible])

From colleges and universities to cutting-edge companies, organizations all over the United States are designing technology-supported learning that works! Come find out what they are!

K–12, University/College; Teachers, Technology Coordinators, Staff Developers; NETS•S: 1–6

Environmental Science with GIS: Science, Geography, and Technology Standards
Daniel Edelson, Northwestern University (IL), Michael Lach, Kathleen Schwille, Matt Skillman, Adam Tarnoff

Room: [illegible]

Using GIS tools we designed specifically for learners, we developed a technology-integrated, inquiry-based high school environmental science course based on geographic case studies.

9–12, Community College; Teachers; NETS•S: 1–3, 5, 6; NETS•T: iii, iv

Education as Communication: Teaching through Connectivity
Kristian Hammond, Northwestern University (IL)

Room: [illegible]

Learn about a technology that allows students to do the important research work of analysis and synthesis, while technology performs the tedious task of search work for them.

General; Teachers, Teacher Educators, Library/Media Specialists, Technology Coordinators, Administrators, Staff Developers

eXPerience Learning: The 21st Century Classroom
Rob Curtin, Microsoft Corp (WA)

Room: [illegible]

Discover how Office XP delivers smarter tools for learning and extends learning beyond the walls of the classroom. See great new Office XP features and solutions that help students, faculty, administrators, and parents save time, collaborate, and use resources more effectively. (Sponsored by Microsoft.)

General; Teachers, Technology Coordinators, Administrators

Creativity Extravaganza! Throwing Mud Pies in the Face of Tradition
John Parry, Mississippi State University, Larry Anderson, Andy Carvin (DC), Bruce "Chip" Daley (NV), Peter Reynolds (MA)

Room: [illegible]

Break out of your traditional mold! Enjoy an explosion of fun as experts reveal successful strategies that enable everyone to teach creatively with technologies.

General; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators

Raw Materials for the Mind
David Warlick, The Landmark Project (NC)

Room: Vista Ballroom ([illegible])

In the Information Age, it is information with which people will work. Preparing our students for their future requires a shift away from information as an end product and toward learning to use information as raw material.

4–12, University/College, Community College; Teachers, Technology Coordinators, Teacher Educators, Library/Media Specialists; NETS•S: 1–6; NETS•T: i–iii, v, vi

BUILDING A FRAMEWORK

The Ultimate Question: Does Your Technology Program Work?
Elizabeth Byrom, SERVE, Inc. (NC), Anna Li

Room: [illegible]

Take a walk with Elizabeth and Anna as they lead you through the steps of developing a successful technology evaluation plan.

General; Technology Coordinators, Teacher Educators, Staff Developers, Administrators

BUILDING TECHNOLOGY CAPACITY

Fund Your Dreams: Grant Writing in the Information Age
Sheryl Abshire, Calcasieu Parish School System (LA), Glenn Johnson (NJ)

Room: [illegible]

Gain insight into effective technology grant development. Receive a comprehensive grant-writing handbook with sample grants and access to an extensive grantwriting Web site resource.

General; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators

Networks for Teachers
Cathy Saal, East Baton Rouge Parish School System (LA), Rusty Weaver

Room: [illegible]

Aimed at the end user who does not provide any type of technical support, this session covers topics that will increase efficient workstation use.

K–12; Teachers, Teacher Educators, Library/Media Specialists, Administrators; NETS•T: i, v

BUILDING HUMAN CAPACITY

Professional Development

Technology Competencies: Encourage Teachers to Become Technologically Fluent
Carolyn Carroll, Lubbock ISD (TX), Larry McHaney

Room: [illegible]

Lubbock ISD has implemented an innovative plan that encourages teachers to become fluent with technology by providing incentives as they demonstrate technological competencies.

General; Teachers, Technology Coordinators, Staff Developers, Administrators; NETS•S: 4–6; NETS•T: i–iii, v, vi

PT³ Perspectives—Lessons Learned about What Works in University Faculty Development
Lyn Mafford, University of North Texas, Carolyn [illegible], Sheila Spurgeon (OK), Tweed Ross (KS), [illegible] (NM), Cathy Zozakiewicz (NM)

Room: [illegible]

PT³ project staffs discuss the faculty development models that are working to address standards and move technology integration from the university classroom into the schools.

University/College; Teacher Educators, Administrators

TUESDAY, 10:30–11:30 AM CONTINUED

Preservice Teacher Preparation

Faculty of the Future: Support for Preparing Tomorrow's Teachers

Catherine Thurston, University of Illinois-Urbana-Champaign, [illegible] Stevens, Johnell Bentz, Katherine Ryan, Don Thompson, Bridget Arnold

Room: [illegible]

Find out about an innovative two-year program for faculty development in technology that has affected the preparation of K–12 teachers at a large college of education.

General; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Administrators

Swimming in Standards: Designing a Problem-Based Curriculum That Integrates Standards

Pamela Wentzel, University of Arkansas-Little Rock, Barbara Stanford, Cheryl Grable, Shirley Freeman-Torres, Warren Kimberly

Room: [illegible]

Learn to design a problem-based curriculum integrating ISTE, NCATE, and content standards into a preservice teacher education program.

6–12, University/College; Teachers, Teacher Educators; NETS•T: I–iv

Leadership and Competencies, Standards, and Certification

A Review of the National Technology Standards for School Administrators

Don Knezek, ISTE/University of North Texas, Heidi Rogers (ID), James Bosco

Room: [illegible]

Participants will have the opportunity to review the draft TSSA document and to provide individual and consensus feedback to the TSSA Project team. (Sponsored by ISTE)

General; Technology Coordinators, Teacher Educators, Staff Developers, Administrators

BUILDING A LEARNING ENVIRONMENT

Early Childhood/ Elementary

<pb> = EC² (Papert in Iowa = Early Childhood Constructionism)

Stan Lindaman, Heartland Area Education Agency (IA), Laurel [illegible], [illegible] Reynolds, Mary Droege, Catherine Gillespie, Christine [illegible]

Room: [illegible]

Seymour Papert established the Iowa Early Childhood Papert Partnership to create a model of "constructionist" learning using new technologies to infuse powerful ideas in PK–3.

K–3, University/College; Teachers, Teacher Educators, Staff Developers; NETS•T: ii, iii

Language Arts/ Social Studies

The Renaissance Files: A Web-Based Learning Experience

Ann Hindman, Cedar Rapids Community Schools District (IA)

Room: [illegible]

Find out how a team of educators was able to bring the Renaissance alive for students through a U.S. WEST grant project.

4–8; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists; NETS•T: ii, iii

Math/Science

LEO EnviroSci Inquiry: Make a Vision into a Reality

Alec Bodzin, Lehigh University (PA), Dawn Bothwell

Room: [illegible]

Learn about the development and first-year implementation of a new K–12 interdisciplinary Web-based curricular project: LEO EnviroSci Inquiry.

General; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators

Computer Science

High School Computer Science: What Approach Should I Take?

Charles Kim, Dalton School (NY), Richard Lamb, Geoffrey Harwood

Room: [illegible]

In this panel discussion, experienced high school teachers present ideas on the curriculum directions they are introducing. In a rapidly changing field, collaboration is an essential ingredient.

6–12, University/College, Community College; Teachers, Administrators

Special Populations

Play Ball!!! Level the Curricular Playing Field through Assistive Technology

Betty Nelson-Higdon, University of Alabama-Birmingham, JoAnn Lee, Lois Christensen

Room: [illegible]

Join us and explore the application of assistive technology to accommodate curriculum in a WebQuest format. Have interactive experiences and receive demonstration software.

K–12, University/College, Community College; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators

Multimedia/ Virtual Reality

Digital Photography—Educational Applications

Terence Cavanaugh, University of North Florida, Cathy Cavanaugh

Room: [illegible]

See new ways to use a digital camera for teaching. Learn tips for creative print projects, low-light photography, special lenses, and motion.

General; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators; NETS•S: 1, 3–5

Enhance Teaching and Learning with Video Production

Cathy McFarland, Robey Elementary-MSD of Wayne Township Schools (IN), Sherry Condon

Room: [illegible]

View sample projects and learn how video production can be used to facilitate a variety of learning styles and engage learners. (Sponsored by ACM SIGCUE)

K–6; Teachers, Library/Media Specialists

The Power of Multimedia

Linda Mills, Greensburg Community Schools (IN), Susan Mills

Room: [illegible]

Tired of reading student's lifeless reports? During this fast-paced session, a media specialist and teacher will guide you in discovering how students create multimedia presentations.

4–12; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists

Internet/Web

Creating Virtual Field Trips

Kenneth Clark, Georgia Southern University, Allen Hawkins, Marti Scherer, Judie Bedell

Room: [illegible]

Technologies commonly found in schools can be used to develop and create virtual field trips. Discuss their advantages for instructional situations.

K–12, University/College; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists; NETS•T: ii, iii

Technology Integration

Use Technology to Integrate and Differentiate Instruction

Deborah Carroll, Franklin Special School District (TN), Mary Mann

Room: [illegible]

Focus on exemplary methods of integrating technology seamlessly into classroom instruction, with a special emphasis on learner differences.

4–8; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Administrators; NETS•S: 1–6; NETS•T: i–vi

Problem Solving and Critical Thinking and Cooperative/ Collaborative Learning

Example Cases: Exchange and Presentation Learning in Japan

Eriko Kawai, Nippon Educational Computing Association (Japan), Hiroaki Nakagawa, Junko Akiyoshi, Naoki Yamamoto

Room: [illegible]

Two example cases on the themes of effective exchange learning and presentation learning will be selected to participate at NECC.

General; Teachers, Technology Coordinators, Administrators

Literacies for the Information Age

Updating the Searching Toolkit

Joyce Valenza, Springfield Township High School/Philadelphia Inquirer (PA)

Room: [illegible]

Have you and your students fallen into searching complacency? Join us as we wake up and smell the new search tools and strategies.

6–12, University/College, Community College; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists

Research and Best Practices in Teaching and Learning

Tools for School Renewal: Delivering Data to the Desktop

Lynn Osler, Hamilton County Educational Service Center (OH), Cindy Cates, Chantell Johnson (IL)

Room: [illegible]

Are your teachers under pressure to use data to guide instruction? Hear about a tool that helps teachers inform instruction based on student needs.

K–12; Teachers, Technology Coordinators, Staff Developers, Administrators; NETS•T: i, iv, v

BEST COPY AVAILABLE

Build a Community of Learners to Support Faculty and Students

Melissa Pierson, University of Houston (TX), Cindy Andrews (IL), Arlene Borthwick (IL), Joyce Morris (VT), Holly Buckland Parker (VT)

Room: [illegible]

[illegible] This session will address ways that developing a "community of learners" can help faculty and students as they strive to integrate technology into their classrooms. (Sponsored by ISTE's SIGTE)

University/College, Community College Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Administrators; NETS•S: 1–3; NETS•T: I–IV, VI

PAPERS

Two papers per one-hour session.

Evaluation of a Laptop Program: Successes and Recommendations

Deborah Lowther, University of Memphis (TN), Steven Ross (TN), Gary Morrison (MI)

Room: [illegible]

Learn how an integration model significantly changed classroom practices and student performance when children had 24-hour access to a personal laptop computer.

4–8; Teachers, Technology Coordinators, Staff Developers, Administrators; NETS•S: 1, 3, 6; NETS•T: II, III

The Evolving Role of School-Based Technology Coordinators in Elementary Programs

Neal Strudler, University of Nevada–Las Vegas, Christy Falba, Douglas Harrington

Room: [illegible]

This session will focus on key aspects of the work of elementary technology coordinators, including their role, strategies, perceived effectiveness, accomplishments, rewards, and frustrations.

K–6; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators

TUESDAY, 12 NOON–1 PM

★ SPOTLIGHT SESSIONS

NECA Lights: Moving Forward with Technology, the Lessons Learned

Kelly Brown, Northeastern University (IL), [illegible]

Room: [illegible]

With the support of a grant from NECA, eight Chicagoland teachers developed integrated technology curriculum units during the 2000–01 school year. Each teacher will provide visual examples of their students' work, discuss the process used to do the unit, and share lessons learned.

Teachers, Teacher Educators

Integrate Technology into the Classroom: Skills Teachers Need to Be Successful

Jennifer Dubow, Institute of Computer Technology (CA), [illegible], John Judge

Room: [illegible]

[illegible] Learn about the five major technology skills teachers must acquire to effectively integrate technology into their existing curriculum to enhance their student's ability to learn.

K–12; Teachers, Teacher Educators, Staff Developers, Administrators; NETS•T: III

Enabling Education through the Next Generation Internet

Joel Mambretti, International Center for Advanced Internet Research and Metropolitan Research and Education Network (IL)

Room: [illegible]

[illegible] The International Center for Advanced Internet Research has established cooperative efforts to create the next generation Internet. Hear how it will change education in profound ways.

K–12, University/College, Community College Teachers, Teacher Educators, Library/Media Specialists, Technology Coordinators/Administrators/Staff Developers

School–Researcher Partnership for Technology-Supported Science Education Reform

Brian Reiser, Northwestern University (IL), Daniel Edelson, Lou-Ellen Finn, Louis Gomez, Chandra James, Joseph Krajcik, Deborah Peek-Brown, Elliot Soloway

Room: Vista Ballroom ([illegible])

Two research universities (Northwestern and Michigan) and two urban school districts (Chicago and Detroit) describe their partnership to reform science education using technology-infused inquiry curricula.

6–12, University/College Teachers, Technology Coordinators, Staff Developers

Empowering Education through Technology

Cheryl Vedoe, Apple (CA)

Room: [illegible]

As technology advances, the possibilities for effectively incorporating computers into education multiply. The introduction of the Internet, wireless technology, and desktop video are just a few of the advancements technology affords administrators, teachers, students, and parents. Hear Apple's vision for continued innovation in educational technology. (Sponsored by Apple, Inc.)

General; Teachers, Library/Media Specialists, Technology Coordinators, Administrators

BUILDING A FRAMEWORK

Safeguard the Wired Schoolhouse

Sara Fitzgerald, Consortium for School Networking (VA)

Room: [illegible]

Learn about district-level options to control students' access to inappropriate Internet content and a checklist to guide the decision-making process.

General; Technology Coordinators, Library/Media Specialists, Administrators

Technology Coordinators' Survival Kit

Timothy Landeck, Santa Cruz City Schools (CA), Doug Prouty, Barbara Bray

Room: Vista Ballroom ([illegible])

[illegible] Learn about and discuss the various aspects of site-, district-, and county-level technology coordination in this a positive and productive look at the difficulties and solutions to the hurdles technology coordinators face.

K–12; Teachers, Technology Coordinators, Staff Developers, Library/Media Specialists, Administrators

BUILDING TECHNOLOGY CAPACITY

SOS: (High School) Students Offering Support

Tammy Fry, Blue Valley USD 229 (KS), [illegible]

Room: [illegible]

[illegible] Students gain real-world training to lessen the gap between school and career. This program combines curriculum and technology skills to prepare students for the future.

9–12; Teachers, Technology Coordinators, Staff Developers, Library/Media Specialists, Administrators; NETS•S: 1–3, 5, 6; NETS•T: II, IV

School Web Pages: Advice from Student Designers

Matthew Mercer, Butler University (IN), [illegible]

Room: [illegible]

[illegible] Students on the front line of Web design share their expertise on designing the school Web page for style, efficiency, and student interest.

6–12; Teachers, Technology Coordinators, Staff Developers, Library/Media Specialists, Administrators

BUILDING HUMAN CAPACITY

Professional Development

Connecting Parents and Teachers on the MUVE

Wendy Bringer, California Lutheran University, Beverly Boyle, [illegible]

Room: [illegible]

Home-school communication is imperative for student success. Explore an action research project in which teachers communicated with parents through Tapped In, a multiuser virtual environment.

K–12, University/College Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators

Overcome Obstacles to Developing and Using Classroom Multimedia

[illegible], Richard J. Daley College (IL), Margaret Johnson

Room: [illegible]

Learn appropriate use of multimedia lectures. View a media-rich PowerPoint® presentation that inspires faculty and demonstrates presentation design.

K–12, University/College, Community College Teachers, Teacher Educators, Staff Developers

Preservice Teacher Preparation

Models for Integrating Technology into Field Experiences in PT³ Projects

Neal Strudler, University of Nevada–Las Vegas, Kara Dawson (FL), Christy Falba, Keith Wetzel (AZ)

Room: [illegible]

[illegible] This session focuses on how PT³ grant recipients have supported mentor and student teachers in including educational applications of technology into field experiences. (Sponsored by ISTE's SIGTE)

University/College, Community College Teachers, Technology Coordinators, Teacher Educators, Administrators; NETS•T: I–IV

TUESDAY, 12 NOON–1 PM, CONTINUED

Preservice Teacher Preparation, Continued

Address the NETS for Teachers in Preservice Education

Susan Tennack, Ball State University (IN), Karen Ford

Room: S501d

See the process used to develop a framework for correlating the NETS for Teachers with assignments in two preservice teacher education courses.

University/College; Teacher Educators, Administrators; NETS•T: i–vi

BUILDING A LEARNING ENVIRONMENT

Early Childhood/Elementary

TLC: Technology and Literacy Connections

Jillian Copeland, Montgomery County Public Schools (MD), Barb Brown, Joel Smatonka

Room: S404b/c

Learn how to integrate technology into your balanced literacy program and teach your colleagues to do the same!

K–3; Teachers, Technology Coordinators, Staff Developers; NETS•T: iii, v

Language Arts/Social Studies

The Infotective: Technology and 21st Century Student Historians

Chad Fairey, Glasgow Middle School (VA), Kenneth Watson

Room: S405a

The Infotective offers a framework that creates student historians for the digital age. Learn how students can think and act historically on their online excursions.

4–12, University/College; Teachers, Teacher Educators, Staff Developers, Library/Media Specialists

Math/Science

Dwarf Frogs, Snails, and Crabs ... Oh My! Science Meets Technology

Virginia Hellmann, Knapp Elementary (PA), Nicole Amsdem, Linda Brzyskarski

Room: S103b/c

Inquiry-based science, here we come! Learn how Pennsylvania's North Penn School District integrates its third-grade animal studies unit with technology and library sources.

K–6; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists; NETS•S: 1–6; NETS•T: i–vi

Use Spreadsheets to Teach Mathematics and Meet Standards

Pamela Lewis, St. Luke School (WI)

Room: S502a/b

Spreadsheets are powerful tools to help students understand basic math concepts like counting, addition, and subtraction. Spreadsheets give the learner a concrete, visual tool for understanding abstract ideas.

K–6; Teachers, Technology Coordinators, Teacher Educators, Staff Developers; NETS•S: 1, 3–6; NETS•T: i–iii, v

Special Populations

The Computer: A Tool to Meet the Needs of Advanced Learners

Margo Hinton, California Association for the Gifted

Room: S404a

See computer software that provides differentiation to meet the needs of advanced learners. And learn how multimedia projects provide necessary skills for these students.

4–8; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Administrators

Internet/Web

Create an Online Learning Environment for Your Students Using the Collaboratory Portal

Tamara McCulloch, Northwestern University (IL)

Room: S102b/c

The Collaboratory Portal integrates collaborative tools and communities for developing and managing Web-based curricular projects and activities for the K–12 classroom.

General; Teachers, Technology Coordinators, Staff Developers, Library/Media Specialists

Technology Integration

Technology in a Toolbox

John Stritt, Educational Service Unit #16 (NE)

Room: S105d

Find out about this three-year project targeted toward the many tasks that need to be accomplished in instruction and learning with the support of technology.

K–12; Teachers, Technology Coordinators, Administrators

Empowering Educators by Sharing Technology Resources

Thomas Tarman, Georgia Institute of Technology (GA), Margie Brown

Room: S401d

Learn how a technology-focused teaching model can be adapted in the classroom to benefit teachers and students. This model also helps improve professional development skills.

K–12, University/College; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators; NETS•S: 3, 5, 6; NETS•T: ii, iii, v

Cooperative/Collaborative Learning

Collaborative Learning on the Internet: Facilitating Team Projects

Rob Schnieder, AHA! Interactive (IL), Jenny Carlson (MA)

Room: S101a

Get prepared to successfully facilitate collaborative, problem-based learning experiences in an online and classroom environment. *(Exhibitor presentation)*

6–12; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Administrators; NETS•S: 3–6; NETS•T: ii–v

Distance/Distributed Learning

Issues in Creation of a Certification Program for Online Instruction

Raymond Rose, Concord Consortium (MA), Zahrl Schoeny (VA), Sherry Hsi (CA)

Room: S404d

It takes experience to develop a quality certification program for online instruction. Talk about the issues and criteria that make for good online instructors.

9–12, University/College, Community College; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Administrators

Multiple Intelligences

Technology + the Arts + Core Curriculum = Enhanced Learning with Multiple Intelligences

Elaine Wrenn, Echo Horizon School (CA)

Room: S102a

A 2000 Computerworld Smithsonian laureate shares how approaching a topic using a variety of learning modalities makes the subject more attainable to all students.

K–12; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Administrators; NETS•S: 1–6; NETS•T: ii, iii

Laptop Learning

How Laptops Change the Learning Landscape

Joseph Hofmeister, Cincinnati Country Day School (OH)

Room: S101b

When everyone has a laptop, there is an essential change in the school as new relationships are made with information and technology..

4–12; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators

BUILDING EQUITY AND ACCOUNTABILITY

Illinois NextSteps: Scaling Up Statewide Technology Assessment

Vicki Dentis, Area Five Learning and Technology Hub (IL), Kristin Ciesemier, Barnajean Porter (CO)

Room: S100

Illinois NextSteps is a statewide project designed to help districts assess technology implementation by developing a set of comprehensive tools and training processes.

General; Technology Coordinators, Administrators, Staff Developers

Are University Web Sites Accessible to Individuals with Disabilities?

Bob Perkins, University of Charleston (SC)

Room: S501b/c

Universities are obligated to provide information to all; however, most university Web sites are problematic for individuals with disabilities. Find out how to correct the situation.

University/College, Community College; Technology Coordinators, Library/Media Specialists

Capturing Eyeballs of Captive Kids

Nancy Willard, University of Oregon

Room: S103a

Should schools barter the private lives and eyeballs of their students for "free" technology resources?

General; Teachers, Technology Coordinators, Staff Developers, Library/Media Specialists, Administrators

PAPERS

Two papers per one-hour session.

Building Awareness of Text Structure through Technology

Edith Slaton, Southeastern Louisiana University

Room: S504a

Text structures provide blueprints of ideas to help readers comprehend written information. Learn how technology can be used to create visual representations of text structures.

K–12, University/College; Teachers, Teacher Educators

Assessing New IT Workers: Adult Women and Underrepresented Minorities

Karen Szuba, University of Phoenix (AZ)

Room: S504a

Learn about an NSF grant that researched the motivations, institution choices, and reasons for university IT/IS degree completion by adult women and minorities.

University/College, Community College; Teachers, Technology Coordinators, Staff Developers, Administrators

TUESDAY, 1:30–3:30 PM

STUDENT SHOWCASE

All Showcases are located in the Vista Ballroom Lobby.

Where's Cody the Coyote?

Anne Berry, Palos Park Elementary School District 118 (IL)

Table 5

A problem-based community project, "Where's Cody the Coyote?" was designed and completed by fourth-grade students and was a Silver Award winner in the International CyberFair 2000 competition. It provided a highly effective demonstration of the power of constructivist learning for our local community.

4–8; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators

A Little Bit of Computers in our Lives

Michael Shapiro, Sacred Heart Schools (IL), Julie Reinhardt

Table 2

Integrate technology with art, music, and physical education? That's what these middle school students have done, creating fascinating multimedia projects in the process.

4–8; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators

Students Speak for Themselves about a High School Laptop Project

William (Bill) Shapiro, Union Hill High School (NJ), Magda Diaz, Julie Rodriguez, Jonathan Mendia, Jose Espinosa

Table 1

Union City High School students will discuss and share examples of their multimedia work generated over the three years of this innovative laptop program.

6–12; Teachers, Teacher Educators, Administrators

Cryder's Writers

Sylvia Tiona, Yorkville CUSD No. 115–Circle Center Intermediate School (IL), Diane Cryder (IL), and Students

Table 3 & 4

Grade 3 students exhibit use of the Web to incorporate home pages, a supply store, a school newspaper, WebQuests, self-portraits, and to display student writing.

4–8; Teachers, Technology Coordinators, Teacher Educators, Staff Developers

POSTERS

All posters take place in Room S401a.

Develop Effective Basic Skills: Learning Environments for Technical College Students

Shelly Bilvere, St. Paul Technical College (MN)

Table 12

See how one technical college effectively delivers basic skills courseware on-site or from home, including development stages, best practices, and lessons learned.

9–12, University/College, Community College; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators

Learning with LEGO Robots

Li-Ling Chen, University of Michigan–Flint, Don Boys, Eric Worch

Table 8

See how middle school students benefit academically, socially, and emotionally from participating in local- and state-level LEGO robotic contests.

4–8, University/College; Teachers, Technology Coordinators, Teacher Educators, Administrators

Integrate WebQuests into Your Classroom for Interactive Learning

She-Hsien Chen, Western Kentucky University

Table 4

Learn to use WebQuests to engage students in interactive learning. Get curriculum ideas for integrating WebQuests into your classroom.

K–12, University/College, Community College; Teachers, Teacher Educators, Staff Developers, Library/Media Specialists

Yahoo! If We Can Do It, So Can You!

Joyce Christman, Bailey Elementary School (OH), Jennifer Neff

Table 6

Five years ago, a techno-challenged staff converged on a new elementary school equipped with five computers per classroom. We've come a long way, baby!

K–6; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators

Instructional Projects with Laptops: University/K–12 Collaboration

Mary Ann Coe, Midwestern State University (TX), Michael Land, Tracy Edwards, Catherine Tonnahill

Table 10

A university purchases iBooks with wireless Internet connection, and K–12 teachers write proposals for use of these computers. Wow—what great things happen!

University/College; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Administrators

Support Technology through Partnerships with People

Juli Gartner, Cooperative Educational Service Agency (WI), Nicholas Dietz, Cherie Francis

Table 2

How do public schools and public libraries support staff, hardware, and software with limited resources (time, money, and people)? Listen while we share our strategies and activities.

General; Teachers, Technology Coordinators, Library/Media Specialists, Administrators

Learn by Creating and Sharing Video Documentaries about Your Community

Mark Grabe, University of North Dakota, Cindy Grabe

Table 9

This poster will describe two projects in which students used the process of video editing to learn about local biological habitats.

6–12; Teachers, Technology Coordinators

Ride the Reading Roller Coaster: Information Age Literacy

Annette Lamb, Lamb Learning Group (TX), Larry Johnson

Table 11

Explore how to connect popular children's and young adult literature with online reading projects, Internet resources, and technology-rich activities to promote Information Age reading.

K–12; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists

Wish You Were Here: Virtual Vacations

Roberta Marshall, Fort Worth ISD/Leslie Merritt Elementary (TX), Beverly Banks

Table 1

Students used digital cameras, scanned images, graphics, and text to create virtual vacation memories. Learn how to implement this motivating project with your students.

K–6; Teachers, Technology Coordinators, Teacher Educators

Teaching and Learning with Technology: Teacher Development Centres

David Pashrell, Woodcrest College (Queensland, Australia), David Allikas, Mark Dimo

Table 7

Learn about professional development in teaching and learning with technology. Attend this reflection on running teacher development centres located in a school, a model for the future.

General; Teachers, Technology Coordinators, Staff Developers, Administrators; NETS•S: v

Integrate Technology into High School Classrooms

Sarah Roth, Tempe Union High School District (AZ), Suzanne Little, Joanne Wood, Keith Lewis

Table 3

Gather ideas and activities for integrating technology into high school classrooms. Best practices, field-tested lessons, activities, Web sites, and student work span multiple subject areas.

9–12, University/College; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators

Teachers, Technology, and the Wild, Wild, West

Stacy VanBoening, Educational Service Unit 16 (NE), Marge Hinchman

Table 5

What could be done to help rural teachers use technology in their classrooms? With this challenge in mind, The Connections Project was born.

6–12, University/College, Community College; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Administrators

WEB POSTERS

All posters take place in Room S401a.

Staff Development at a Distance: Online Learning Modules

Andrew Bowen, Valdosta State University (GA)

Table 24

Explore and discuss the creation, delivery, and evaluation of online learning modules on Internet skills, part of a school improvement project serving rural south Georgia.

General; Teachers, Technology Coordinators, Staff Developers, Library/Media Specialists; NETS•T: i, ii, iv

Supporting Collaborative Student Inquiry in Online Courses

Richard Carter, Lesley University (MA)

Table 13

See examples of activities that model and support collaborative student inquiry in online courses and a framework for designing such activities.

9–12, University/College; Teachers, Teacher Educators, Staff Developers

So You're on the Internet. Now What?

Jean Chapin, SmartStuff Software (OR), Katie Wood

Table 20

See methods for integrating Internet content into core curriculum. Learn to find, use, and modify the best Internet resources for all grade levels. *(Exhibitor presentation)*

General; Teachers

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TUESDAY, 1:30–3:30 PM CONTINUED

Technology Leadership Institute: A Vehicle of Change

Jim Dillmann, Jefferson County Public Schools (KY), Doug Reed, Carolyn Rude-Parkins

Table 21

Learn how the Technology Leadership Institute helps increase teachers' technology expertise and fosters leadership in curriculum and school change with technology

General; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators

middleschool.com: A Site Designed with Middle Schools in Mind!

James Pech, Middle School Partnership (CT)

Table 22

Learn about a great free Web resource—middleschool.com—and how it serves middle-level educators, administrators, and parents with original content, resource units, and a deep set of easy-to-use links!

4–8; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators

Virtual Museums: The Quest for Knowledge

Pat Kardia, Cluster A Consortium (WI), Judy Dehen, John Kassel, Mary Stevens

Table 16

See classroom application of five virtual museums created by teams of teachers, parents, and students. Learn a step-by-step process for creating a virtual museum.

4–12; Teachers, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators; NETS•S: 1–6; NETS•T: i–vi

A Review of Network Learning Systems and the Shadow netWorkspace

James Laffey, University of Missouri–Columbia, Dale Musser, Herbert Remidez, Christopher Amelung

Table 17

Learn about new teaching and learning process enabled by networked learning systems through a demonstration of Shadow netWorkspace.

K–12; Teachers, Technology Coordinators, Teacher Educators, Library/Media Specialists

Using QuickTime™ Virtual Reality for Engaging, Web-Based Interactivity

Eric Meyers, Walled Lake Schools (MI)

Table 19

Build QTVR movies quickly and easily! Learn how to use this technology to enhance Web-based communication and immersive learning.

6–12; Teachers

Integrate Writing and the Internet across the Curriculum

John Orr, Writers' Online LLC and Kidlink (NH)

Table 15

Learn strategies for using the Internet to teach writing across the curriculum and see a demonstration of a collaborative writing environment called the Writing POD.

4–12, University/College; Teachers, Technology Coordinators, Staff Developers, Administrators

River Link: From the Illinois to the Amazon

Nancy Ross, John G. Shedd Aquarium (IL)

Table 14

Discuss Shedd Aquarium's collaboration with 20 schools and the Illinois State Board of Education to explore aquatic ecosystems through technology-based engaged learning activities.

K–12; Teachers, Technology Coordinators, Staff Developers, Library/Media Specialists

Align Preservice Teacher Technology Competencies with the New NETS•T

Pam Wenger, Minnesota State Colleges and Universities (MNSCU)

Table 23

We are one big step ahead of our NECC 2000 presentation. Experience the alignment of our preservice teacher competencies with the new NETS•T!

Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators

TUESDAY, 1:30–2:30 PM

SPOTLIGHT SESSIONS

A Pattern Language for WebQuests and Other Learning Environments

Bernie Dodge, San Diego State University (CA)

Room: S100

This session will present a fresh and practical way of thinking about how to design constructivist learning environments using concepts borrowed from architecture.

General; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists; NETS•T: ii, iii

enGauge: A Knowledge Base, An Online Assessment, and Proven Resources

Cheryl Lemke, Metiri Group (CA), Gil Valdez (IL)

Room: Vista Ballroom (S406a)

Why does technology work in some schools and not others? Join a thought-provoking discussion to answer that question through the enGauge Web framework and tools.

University/College Technology Coordinators, Library/Media Specialists, Administrators; NETS•S: 1–6; NETS•T: i–vi

Scaffolding for Success

Jamie McKenzie, From Now On—The Educational Technology Journal (WA)

Room: Vista Ballroom (S406a)

Surfing the Internet has not proven especially valuable or attractive to hard-pressed classroom teachers, but more carefully structured research experiences can provide a greater payoff and gain broader acceptance. McKenzie outlines the key ingredients that make scaffolding an effective approach to unit development and provides examples for teachers to use or emulate.

Wireless Technology in Your Classroom

Malcolm Williamson, Stephen Hayes School–Chicago (IL), The Internet Coach®, Motorola, WorldCom/Skytel, APTE/Internet Coach® Staff

Room: S105a

Join conference sponsors in a session demonstrating how wireless technology and handheld devices are revolutionizing education. See teachers e-mail parents, get real-time data and collaborate on projects with other classrooms using the Motorola Timeport™, with WorldCom/Skytel service and APTE/Internet Coach® applications. Participate in exciting demonstrations of many administrative and student applications. (Sponsored by Motorola, WorldCom, and APTE.)

K–12, Community College, University/College; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators

BUILDING TECHNOLOGY CAPACITY

A District Solution for Communicating, Collaborating, and Learning Online

Stewart Lynch, School District No. 38 (BC, Canada)

Room: S102d

See how the Richmond (British Columbia) School District became paperless! FirstClass brings teachers, students, and parents together—connecting from home or school to exchange information.

General; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators

Understand and Use Streaming Video

William Pickett, The Bryn Mawr School (MD)

Room: S102a

This presentation will involve discussion and demonstration of various video streaming techniques using both hardware and software devices. Real-world uses will be illustrated.

K–12; Teachers, Technology Coordinators

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BUILDING HUMAN CAPACITY

Professional Development

Best Practices for Professional Development Providers

Marilyn Heath, Southwest Educational Development Laboratory (TX), Jackie Burniske

Room: S100a

Learn effective professional development strategies for creating commitment, participation, and follow-through from your teachers so they will integrate technology into their classrooms.

K–12; Staff Developers; NETS•T: i–vi

Integrate Technology and Reading Instruction to Improve Reading Achievement

Nancy Morell, Arrowhead Area Education Agency (IA), Gail Galbraith

Room: S104

Learn how this innovative leading project can be used as a model for designing Web-based professional development opportunities, integrating technology with research and best practice.

General; Teachers, Teacher Educators, Staff Developers, Administrators

Learn to Lead with Technology in Online Staff Development

Heidi Schweizer, Marquette University (WI), Joan Whipp, Kathy Sturgis, Sharlyn Brown, Mary Delgado, Francine Smith-Mech, Char Hartman

Room: S405b

See an online technology course that has encouraged K–12 teachers to become technology leaders. Interact with those leaders and their student technology projects.

General; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Administrators

Preservice Teacher Preparation

Teaching Teacher Educators: Effective Strategies for Faculty Development

Gloria Bowman, SUNRAY at SERVE (NC), Lisa Harris (SC)

Room: S501a

Come with a problem, leave with a solution. The academy approach to professional development in technology for teacher educators is yielding promising results.

University/College; Teacher Educators, Staff Developers; NETS•T: i–vi

Two Models of Incorporating NETS into Preservice Teacher Education

Rebecca Peterson-Lacey, Lesley University, Center for Academic Technology (MA); Michael McDonald (NE)

Room: S501d

Examine technology integration projects conducted in coursework and student teaching/internships from two university preservice programs as based on the K–16 NETS.

University/College; Teachers, Teacher Educators, Staff Developers, Administrators; NETS•T: ii, iii

Learning and Teaching Elementary Mathematics with Spreadsheets

Kay Roebuck, Ball State University (IN), Leslie Cassell, Shelly Hashan

Room: S304d

See how spreadsheet projects help preservice teachers strengthen their own understanding of numerical relationships while creating products to use with students in Grades 3–8.

University/College, Community College; Teacher Educators

Leadership and Competencies, Standards, and Certification

Technology Leadership Training for School Administrators: Lessons Learned

Sheila Cory, University of North Carolina, Helen Soule (MS), Ann Bellitsky (FL)

Room: S103d

Three directors of statewide technology leadership programs for principals and superintendents share lessons learned from the first year of implementation of their programs.

General; Technology Coordinators, Staff Developers, Administrators; NETS•T: iv

Student Technology Leaders—Build Tomorrow's Leaders Today!

Charlestine Pook, Jessamine County Schools (KY), Matt Byars, Christina Perkins, Scott Carrano, Nat Sallee, David Stone

Room: S404d

In Jessamine County, Kentucky, students run the network and help desk, and they train teachers. Discover how they get their training, what their jobs involve, and our future plans.

General; Teachers, Technology Coordinators, Administrators; NETS•S: 1–6; NETS•T: ii, iii, vi

BUILDING A LEARNING ENVIRONMENT

Language Arts/Social Studies

Desktop Poetry Project

Judith Greene, Columbia University (NY), Emily Scharf

Room: S400a

See a model of an integrated project in English, art, and computer science. Leave with materials to replicate the project in their classrooms

6–12; Teachers, Technology Coordinators, Teacher Educators, Library/Media Specialists; NETS•S: 1–6

Math/Science

SeaTrek: Videoconferencing to Enhance Elementary School Science Curriculum

Elizabeth Metz, Mote Marine Laboratory (FL), Michael Hynes, Dennis Krebill, Juan Ramos

Room: S103b/c

Learn about this exciting telementoring program that uses videoconferencing to enhance the elementary school science curriculum.

4–8; Teachers, Technology Coordinators, Administrators; NETS•S: 1, 2, 4–6; NETS•T: i–iii

Prealgebra and Algebra: A Year's Worth of Technology-Connected Lessons

Kathy Traylor, Holcomb Bridge Middle School (GA), Ray Kroneck

Room: S306a/b

From the newest algebra games to digital video, you'll get technology-connected lessons to use every week of the year in your math classroom!

6–12; Teachers, Technology Coordinators, Staff Developers; NETS•S: 1–6; NETS•T: iii, iv

Computer Science

WebQuests in the Computer Science Classroom

Doug Peterson, Greater Essex County District School Board (ON, Canada), Harry Green

Room: S304b/c

Integrate the Internet into the computer science classroom in a meaningful way. Learn to use your students' interest in all things Web to support their learning of computer science concepts.

9–12; Teachers

Other Subjects

Music Listening and Technology: The National Standards in Music Education

David Williams, University of South Florida

Room: S501b/c

Learn about various approaches to enhancing children's music listening skills using a variety of software. The National Standards in Music Education will be addressed.

General; Teachers, Technology Coordinators, Teacher Educators

Instructional Strategies & Classroom Management with Technology

Ignite and Invite Student High Performance in a Digital Age

Bob Dorsell, Township District 214 (IL)

Room: S401d

Discover how to help students become responsible, motivated, technologically literate learners. Learn to explicitly teach students five powerful strategies that accelerate technology-based learning.

4–12; Teachers, Staff Developers, Administrators

Effective Management and Instructional Strategies for the One-Computer Classroom

Eric LeMoine, Beaverton School District (OR)

Room: S101a

Frustrated with the one-computer classroom? Using practical examples and scenarios, Eric will demonstrate the planning, design, and implementation of effective learning environments in your classroom.

K–6; Teachers, Technology Coordinators, Teacher Educators, Staff Developers

Multimedia Mania International Awards: Project Winners from ISTE's HyperSIG

Caroline McCullen, SAS inSchool (NC), Ellen Vance

Room: S103b/c

See winning projects from this exciting multimedia award program. Learn classroom tips, multimedia techniques, and integration strategies from K–12 teacher winners. Rubrics, handouts, and URLs for your classroom! (Sponsored by ISTE's SIGHY)

K–12, University/College, Community College; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators

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TUESDAY, 1:30–2:30 PM CONTINUED

Project-Based and Problem-Based Curricula

Jambo! Join the Lightspan Online Expeditions Center

Yvonne Marie Andres, Global SchoolHouse at Lightspan.com (CA), Dell McNabb (FL), students

Room: S402

The Lightspan Online Expeditions center is a great place for students to learn from real explorers as they travel to interesting and exotic locations around the globe.

(Exhibitor presentation)

K–8; Teachers, Technology Coordinators, Library/Media Specialists

Tech-Know-Build Challenge Grant: Facilitating Problem-Based Technology Integration

Kathleen Koch, Crawfordsville Community Schools (IN), Peggy Ertmer, James Lehman, Kathleen Steele

Room: S102b/c

Find out about the Tech-Know-Build challenge grant initiative focusing on teacher development process and the first year of implementation of problem-based learning units that integrate technology

6–12, University/College; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators; NETS•T: III

Literacies for the Information Age

Internet Tools for Teaching Electronic Information Literacy Skills

David Raker, Massachusetts State College, Westfield, Jamie Callen (PA)

Room: S105d

Can students learn to effectively use the Internet? Project K12-Search presents strategies, resources, and tools to teach electronic information literacy in elementary and middle school classrooms.

4–8; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists

Student Assessment

Build Technology-Supported Assessments for Urban Classrooms

Bill Penuel, SRI International (CA), Linda Shear, Barbara Means

Room: S101b

Having trouble measuring technology-supported learning with standardized tests? Learn about assessments to measure and improve learning in project- and inquiry-based classrooms.

4–12; Teachers, Technology Coordinators, Teacher Educators, Administrators

BUILDING EQUITY AND ACCOUNTABILITY

Girl Geeks? Technology Is Not Just for Boys Anymore!

Caren Cramer, Bryn Mawr School (MD), Lynn Byank

Room: S404b/c

Technology is not just for word processing and research! Help elementary-level girls become savvy computer users, creative innovators, and lifelong learners with technology.

K–6; Teachers, Technology Coordinators, Administrators

Computer Support for Migrant/ESL Students in Regular Secondary Classrooms

Carolyn Knox, University of Oregon

Room: S404a

Learn about a computer-based system for providing portable and wireless bilingual notetaking assistance for migrant students in regular content-area classes at the secondary level.

6–12, University/College, Community College; Teachers, Teacher Educators, Staff Developers, Administrators

PAPERS

Two papers per one-hour session.

Enhance Elementary Students' Creative Problem Solving through Project-Based Curriculum

Romina Jamieson-Proctor, Queensland University of Technology (Australia)

Room: S504a

This paper describes the positive effect of an approach to creative problem solving involving project-based, collaborative, thematically integrated, and technology-rich curriculum units.

4–8; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Administrators

Middle School Students as Multimedia Designers: A Project-Based Learning Approach

Min Liu, University of Texas–Austin, Yu-ping Hsiao

Room: S504a

A report on engaging middle school students as multimedia designers using a project-based learning approach and constructivist framework.

4–12, University/College, Community College; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists

TUESDAY, 3–4 PM

★ SPOTLIGHT SESSIONS

Teaching in the Digital Age: Preservice, Inservice, and More

Sara Armstrong, The George Lucas Educational Foundation (CA)

Room: S405b

When leadership is fostered throughout the learning community, great things can happen for kids. The George Lucas Educational Foundation will share its latest findings.

General; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators

Constructivism and Online Communities

Amy Bruckman, Georgia Institute of Technology (GA)

Room: S103d

Hear why a constructivist approach to the design of Internet-based learning environments is necessary. And see projects developed in Georgia Tech's Electronic Learning Communities group.

K–12, University/College, Community College; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators

Bridge the Child Divide

Odd dePresno, Kidlink (Norway)

Room: S104

What divides them, really? The quality of their interpersonal knowledge networks! How do we help them build one? Does the overprotected kid stand a chance?

K–12; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators

Technology in Our Schools: Have We Learned Enough to Prepare for the Road Ahead?

David Dwyer, Apple, Inc. (CA)

Room: Vista Ballroom (S406a)

In 1986, Apple Classrooms of Tomorrow began a decade-long journey to understand the effect of technology on teachers and students and on teaching and learning. What was learned, and what has been learned since? What issues remain unresolved?

K–12; Teachers, Teacher Educators, Library/Media Specialists, Technology Coordinators, Administrators, Staff Developers

Portfolios for Assessment and Accountability

David Niguidula, Ideas Consulting (RI), Hilarie Davis

Room: S402

Learn how digital portfolios can help your school community work together to document its goals, reflect on its activities, and chart a course toward improvement.

General; Teachers, Technology Coordinators, Staff Developers, Administrators

NASA's Education Portal—Your Cyber Gateway to NASA Involvement

Ellen Wild, NASA Headquarters Education Programs Office (KS)

Room: Vista Ballroom (S406a)

Discover cutting-edge resources that expand your curriculum and challenge your students! Let NASA representatives connect you to NASA's multimedia and electronic curriculum support materials.

General; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators

BUILDING TECHNOLOGY CAPACITY

Work Smarter, Not Harder: Student Programmers as School Problem Solvers

Matthew Byars, East Jessamine Middle School (KY), Charles Young, Beau Murphy, Justyn Settles

Room: S501b/c

Looking for ways to streamline staff data collection, but you aren't a programmer? Your students can help—have them use FileMaker Pro® to create user-friendly databases.

K–12, University/College; Technology Coordinators, Staff Developers, Administrators

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Going Thin

Joe Huber, Greenwood Schools (IN)

Room: [illegible]

Can thin clients and Internet appliances reduce your total cost of ownership (TCO) and help stretch your technology dollars?

General; Teachers, Technology Coordinators, Teacher Educators, Administrators

BUILDING HUMAN CAPACITY

Professional Development

A Model to Engage Teacher Education Faculty in Technology Infusion

Otto Benavides, California State University–Fresno, Robin Chiero

Room: S304d

Through a PT³ grant, teacher education faculty are engaged in effective technology infusion. Learn about the model and its implementation.

University/College; Teacher Educators, Staff Developers

Teaching Interdisciplinary Problem Solving: Professional Development Models and Curriculum Resources

Melissa Chessler, Metis Associates, Inc. (NY), James Carroll

Room: S103a

See professional development models and curriculum resources that have enhanced teachers' knowledge of technology and ability to apply technology for meaningful, educational purposes.

6–12; Teachers, Technology Coordinators, Teacher Educators, Staff Developers; NETS•S: 1–6; NETS•T: i–vi

Student Empowerment, Professional Development, School Reform: The Swiss Army Knife Approach

John Hardy, Generation www.Y (WA), Michael Coe (OR), Marilyn Piper, Craig Castello

Room: S404d

Consider the essential participation of students in the process of technology infusion, professional development, and school reform. And see evaluative results of real-world implementations.

4–12, University/College; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Administrators; NETS•S: 1–6; NETS•T: i, iii

The AECT Project: Certifying Educational Competence with Technology

Kyle Peck, Penn State University; Catherine Augustine, Nadia Humphreys, Susan, and Jennaline Lynes; David Papp, Martin Yeh, Mark Hunter (TN)

Room: S104d

This project identifies the technology knowledge and skills needed by teachers in 37 specific teaching roles and awarding technology certificates to teachers who possess them. (Sponsored by AECT)

K–12, University/College, Community College; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators

An Innovative Approach to Creating Web-Enabled Teachers

Jim Swett, Chicago Public Schools (IL)

Room: S106

Technology Infusion Planning (TIP) offers a comprehensive professional development model for using technology in the classroom to improve student achievement.

K–12, University/College, Community College; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators

Preservice Teacher Preparation

Professional Development with Teacher Educators: Integrating Technology into Methods Courses

Leslie Hall, University of New Mexico, Dee Holmquist, Matt Magnusson, Sandra Massetti, Darcy Simmons-Klever

Room: S501a

Attend this panel report on professional development for 25 teacher education faculty including the scaffolding needed as they integrate technology-based activities into preservice methods courses.

University/College; Teacher Educators, Administrators; NETS•T: ii–vi

Prepare Preservice Teachers for NETS

Sandra Madison, University of Wisconsin-Stevens Point, with Elaine Hutchinson and students Chad Bohnke, Cheryl Wojcik, and Robin Unruh

Room: S501d

The presentation describes the curriculum and teaching activities that student teachers experience in the learning technologies minor at the University of Wisconsin–Stevens Point.

General; Teachers, Technology Coordinators, Teacher Educators; NETS•T: i–vi

BUILDING A LEARNING ENVIRONMENT

Language Arts/Social Studies

The Power of Their Responses: Humanities and the Internet

Elizabeth Hofreuter, The Linsly School (WV), Darryl Cross

Room: S405a

Discover many ways the Internet reinvented the educational experience in one high school humanities class.

9–12, University/College, Community College; Teachers, Teacher Educators, Staff Developers

Math/Science

Hitch a Ride on a Satellite: GPS in the Classroom

Anton Nimm, Central New York Regional Information Center, Jim Kohl

Room: S105b/c

Global positioning satellite (GPS) receivers can be used to teach science and social studies. GPS data collected by students can be used with mapping software!

4–12; Teachers, Staff Developers, Library/Media Specialists; NETS•S: 1–6; NETS•T: i–v

Produce Interactive Problems of the Week: Component-Based Integration Teams

Jeremy Roschelle, SRI International (CA), Chris Digiano, Judy Underwood, Suzanne Alejandre, Alexander Repenning

Room: [illegible]a/b

Learn how distributed teams of teachers, software developers, and Web producers create an innovative series of biweekly interactive mathematical challenges that support NETS and NCTM standards.

6–12; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists; NETS•S: 3; NETS•T: ii, iii

Special Populations

Teaching and Learning on the Web in ESL Class

Linda Welshhon, Hunt Middle School (VT)

Room: S404a

Want to start using the Web in your classroom? Learn how I incorporated teaching and learning on the Web into my ESL classroom.

6–8; Teachers, Technology Coordinators, Staff Developers; NETS•T: ii, iii, vi

Technology Integration

E-world Classroom Applications

Diane Dell, AWS Convergent Technologies, Inc. (MD)

Room: S102a

Bring technology excitement into your classroom. Delight students with inquiry-based activities. Discover a learning tool that helps your students develop skills needed for today's e-world.

(Exhibitor presentation)

General; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Administrators; NETS•S: 1–6; NETS•T: i, iii, iv

KIDS Grant: Teacher-Driven Online Professional Development

Gayle Wilson, Allen ISD (TX), Linda Snapp, Russell Long, Karen Hein, Karen Najera

Room: S404b/c

KIDS, a Technology Innovation Challenge Grant, focuses on developing rich, individualized technology-integration training for teachers. Visit and explore our free, online, teacher-friendly environment.

K–12, University/College; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators; NETS•T: i–vi

Instructional Strategies & Classroom Management with Technology

Effectively Use Technology in the One-, Two-, or Few-Computer Classroom

Anne Meyer, Houston Independent School District (TX)

Room: S101a

Classroom computers and connectivity percentages are up! How effective is their use? Learn organizational tips and strategies for the one-, two-, or few-computer classroom.

K–12; Teachers, Technology Coordinators, Teacher Educators, Administrators

Scaffolding for Student Learning

Toni Norris, Langley Academy of Communication Arts (SC)

Room: S105b/c

Take away proven techniques that will provide scaffolds to increase student learning while integrating technology into the curriculum.

K–12, University/College; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Administrators; NETS•T: i–iv, vi

TUESDAY, 3–4 PM CONTINUED

Technology-Intensive Project-Based Problem Solving: A Student Model

David Tucker, Mt. Baker High School (WA), Kim Rabbitt

Room: S102b/c

Learn how to investigate real-world research problems using a technology-intensive model. Using a variety of technology tools, students become active learners and thinkers. Filmed by CNN News.

4–12, University/College; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Administrators

Literacies for the Information Age

Born to Be Wired: Rebootie NetSavvy in an Information Age

Anita Doraf, The InfoSavvy Group (Canada), Brian Macdonald

Room: S106A

Feeling infowhelmed? Here's a solution: NetSavvy, an integrated problem-solving framework for information fluency based on the five A's (Asking, Accessing, Analyzing, Applying, and Assessing).

General; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators

Laptop Learning

Laptops—The Next Generation

Linda Gatterman, New York City Board of Education, Gladys Delli Pizzi, Christine Malgrave, Andrew Coleman

Room: S101b

Laptops in a high-poverty, inner-city school district—ridiculous! See how the CSD 6 laptop program (5,000 strong) turns students into leaders and mentors.

General; Teachers, Technology Coordinators, Staff Developers, Administrators; NETS•S: 3

BUILDING EQUITY AND ACCOUNTABILITY

Spotlight on Learning with Technology: Where Is the Focus?

Connie Champlin, INTE Consulting (IN), Nancy Miller

Room: S401d

Billions of dollars have been spent on technology, but what are the results? Learn about strategies, tools, and techniques essential for quality assessment and planning.

General; Teachers, Technology Coordinators, Staff Developers, Library/Media Specialists, Administrators

Multimedia/Virtual Reality

Meet State and National Standards with HyperStudio® Projects

Doug Lynn, Knowledge Adventure (MN)

Room: S105a

There is much talk about using standards as the basis for classroom curriculum and technology integration. Explore how HyperStudio can meet your technology integration and curriculum standards.

(Exhibitor presentation)

K–12, University/College, Community College; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators; NETS•S: 1–6; NETS•T: I–VI

PAPERS

Two papers per one-hour session.

The Impact of an Innovative Model of Technology Professional Development

Vivian Johnson, Hamline University (MN)

Room: S304a

This paper describes a framework for technology staff development focusing on building links between technology and instruction and describing the pilot test results.

K–12, University/College, Community College; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Administrators

A Model for Pedagogical and Curricula Transformation with Technology

David Wetzel, Muskingum College (OH)

Room: S304a

Learn about the STAIRS Model, developed to overcome the contextual influences teachers encounter when implementing and integrating instructional technology.

General; Teachers, Technology Coordinators, Staff Developers, Administrators; NETS•T: I–VI

TUESDAY, 4:30–5:30 PM

★ SPOTLIGHT SESSIONS

The New Vertical File: Delivering Great Images and Data to the Desktop

Jamie McKenzie, From Now On—The Educational Technology Journal (WA)

Room: Vista Ballroom (S400a)

Concerned that educators have too little control of the electronic resources available to students, McKenzie offers The Network Manifesto: Beliefs to Create Vibrant Networks Serving Literacy and Learning.

K–12; Teachers, Educators, Library/Media Specialists, Technology Coordinators, Administrators, Staff Developers

The Snapshot Survey Service: Make Informed Decisions about Professional Development

Elliot Soloway, University of Michigan, Cathleen Norris (TX)

Room: S105

In this session, we report the findings from our Internet-based surveys to help develop a clear picture of the different professional development needs of educators and present the Snapshot Survey for attendee use.

K–12; Technology Coordinators, Administrators, Staff Developers

Renaissance Two: A Glimpse of the Future

David Thornburg, Thornburg Center for Professional Development (IL)

Room: Vista Ballroom (S400b)

Explore the future of the Web, the fastest growing communication technology in history. See why we are poised at the edge of an era of unprecedented creativity and exploration that will transform all aspects of work, education, and life. See tools that encourage the blending of art, science, and math and that foster the creative revolution that might well transform education in the coming years. (Sponsored by Canter & Associates)

4–8, University/College, Community College; Teachers, Teacher Educators, Library/Media Specialists, Technology Coordinators/Administrators/Staff Developers

BUILDING TECHNOLOGY CAPACITY

Protect Your Students' Identities on the Web

Lee Keller, Jr., West Palm Beach School District (FL), Brenda Thomas

Room: S106

Protect your student's privacy as you further integrate Web technology into your curriculum. Learn how to maintain "safe" Web site content while teaching necessary Web skills.

(Exhibitor presentation)

4–12, University/College, Community College; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators

Build an Advanced Technology for the Future

Karl Martin, Dakota Science Center (ND), Pat Dundee

Room: S102a

Our gamble: create a multiplatform server network to deliver advanced technology applications to as many educators as possible and make the Web site collaborative. We won.

University/College, Community College; Technology Coordinators, Staff Developers, Library/Media Specialists, Administrators

BUILDING HUMAN CAPACITY

Professional Development

Andragogy and Technology

Kathryn Matthew, Louisiana Tech University, Rebecca Callaway, Catherine Letendre

Room: S103a

Explore *andragogy*, adult learning theory. Discover how it affects technology professional development as well as teaching and learning in university classrooms.

General; Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators

Beyond Train the Trainer: Mentoring New Facilitators

Laura Mangel, Fermilab Education Office (IL), Sharon Getz, Christine Marszalek, Stephen Mahon, Jill Mueller, Pat Pound, Cheryl LeMaster, Sharon White

Room: S103d

Discover lessons learned from three years of mentoring new facilitators for an online course on technology-supported engaged learning (LIeC). Strategies are applicable to other courses.

K–12, University/College, Community College; Technology Coordinators, Teacher Educators, Staff Developers, Administrators; NETS•T: I–VI

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TUESDAY, 4:30–5:30 PM

Professional Development, Continued

IMPEL—Engaged Learning into the Future

Robbie O'Connell, Professional Development Alliance (IL), Lorianne Snader

Room: S402

Are you tired of hearing how "everything is engaging"? See a Web site of exemplars. "IMPEL" yourself into the future of engaged learning training.

General; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Administrators; NETS•T: II, III

Diagnose and Treat Technology Phobias in Your School

Kathy Schrock, Dennis-Yarmouth Regional School District (MA)

Room: S401d

Learn tips and tricks for treating the symptoms and causes of technology phobias in your school. Investigate how to change the climate to one of ready acceptance of technology integration.

K–12; Teachers, Librarian/Media Specialists, Technology Coordinators, Administrators, Staff Developers; NETS•T: ii, iii, v

Preservice Teacher Preparation

The Transforming Teacher Education Project: Co-reform in West Central Georgia

Elizabeth Helms, Columbus State University (GA); Polly Adams

Room: S501a

The College of Education at Columbus State University's Transforming Teacher Education Project is a meritorious endeavor that is preparing West Central Georgia's preservice postsecondary educators to use modern technologies to improve student learning within a standards-based curriculum.

K–12, University/College; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Administrators; NETS•S: 1–6; NETS•T: i–vi

Leadership and Competencies, Standards, and Certification

A School–University Partnership Model for Developing Student Technology Leaders

Melissa Pierson, University of Houston (TX), Kathy Booth, Sara McNeil, Bernard Robin

Room: S501d

MultiMedia Masters is a unique school–university partnership designed to simultaneously develop student leaders and technology-proficient teachers. Learn about the project design, challenges, and achievements.

University/College; Teachers, Technology Coordinators, Teacher Educators, Administrators

ISTE NETS for Teachers: Identifying Performance-Based Assessment Measures

Lajeane Thomas, Louisiana Tech University, Helen Barrett (AK), Meg Ropp (MI), Doug Daniell (OR)

Room: S504

Drafts of performance-based assessment instruments, processes, and time lines to measure success in addressing the ISTE NETS for Teachers are presented and feedback for refinement solicited. (Sponsored by ISTE)

General; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Administrators

BUILDING A LEARNING ENVIRONMENT

Early Childhood/Elementary

Technology and Young Children: Use Technology to Encourage Learning

Judy Van Scoter, Northwest Regional Educational Laboratory (OR)

Room: S404b/c

What can technology do for young children? Explore ways to use technology to encourage learning. Leave with effective strategies, new ideas, and research-based information.

K–3; Teachers, Teacher Educators, Staff Developers, Library/Media Specialists; NETS•S: 2, 3, 6; NETS•T: ii, iii, vi

Language Arts/Social Studies

National Geographic's Free Web Site: Your Curriculum Solution

Kathryn Bailey, [illegible] School (GA)

Room: S40[illegible]

Well organized. Extensive. Find a wealth of information for creating cross-curricular lessons that incorporate science, social studies, diverse cultures, content reading, mapping, and geography.

General; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators

Math/Science

Technology-Intensive, Standards-Based, Middle School Mathematics Curricula

George Reese, MSTE Office, University of Illinois–Urbana-Champaign

Room: S501a/b

This session will illustrate how Illinois and national mathematics standards can be implemented and enhanced with the use of digital technologies.

6–8; Teachers, Technology Coordinators, Staff Developers

Robots in the Classroom: NASA's Robotics Education Program

Jeffrey Seaton, NASA Langley Research Center (VA)

Room: S103b/c

Robots are used in many ways on various NASA missions. See demonstrations and examples of how robots can be used in your classroom as well!

4–12; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators

Computer Science

Ethics: The Dilemma of Technology

Jill Joseph, Carl Hayden Community High School (AZ), Dianne Braden (AZ), Chris Walker (AZ)

Room: S504b/c

Ethical traps and dilemmas abound in cyberspace. Where are they? What are they? Discuss ethics questions and answers focusing on school staff and students.

6–12; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators

Special Populations

Address the Digital Divide with *ESTRELLA

Brenda Pessin, Illinois Migrant Council, Jeri Kinser, Benjamin Mireles (TX)

Room: S404a

ESTRELLA is a laptop computer project addressing the needs of secondary migrant farmworker students. Students earn credits for graduation while away from their home-base school.

6–12; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Administrators; NETS•S: 1–5; NETS•T: ii, iii

Multimedia/Virtual Reality

Introduction to Interactive Multimedia Presentation Using Real and SMIL

Cathy Cavanaugh, University of North Florida, Terence Cavanaugh

Room: S103d

Learn the basics of creating multimedia presentations using free SMIL and Real tools. Learn to work with audio, text, graphics, and Web delivery.

General; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists; NETS•S: 1, 3, 4, 5; NETS•T: i–v

Internet/Web

Rural Education, Curriculum of Place, and the Web

R. L. Brien, South Dakota State University

Room: S501b/c

Examine the Web as a medium that can serve as both a resource and arena for implementation of curriculum of place.

K–12; Teachers; NETS•S: 2–6; NETS•T: iii, vi

Make Your School Web Site Dynamic

James Lund, Moorhead Area Public Schools (MN)

Room: S102b/c

Still serving static resources? Learn tricks and tips for making your school's Web site dynamic.

9–12; Teachers, Technology Coordinators, Staff Developers, Library/Media Specialists, Administrators

Technology Integration

Educational Software: What's New and Exciting for 2001?

Eileen Barrett, Lesley University (MA), Michael Powell

Room: S103a

Confused about which software titles will enhance your teaching? The number of new educational software titles on the market is overwhelming. Get some basic tips about evaluating educational software and see some of our favorite titles.

K–12; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators; NETS•T: II

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TUESDAY, 4:30–5:30 PM CONTINUED

Instructional Strategies & Classroom Management with Technology

Teacher Tools and Time Savers for the Classroom

Forest Barbieri, Forest Technologies (IL)

Room: S101a

Technology can enhance more than classroom curriculum—great programs can make your job easier. Become more organized, improve your time management skills, and increase your productivity. *(Exhibitor presentation)*

K–12; Teachers; NETS•S: 1–5; NETS•T: I–III

Use Technology to Differentiate Instruction

Paula White, Albemarle County Schools (VA), Becky Fisher

Room: S100b/c

See examples of how differentiating instruction through technology promotes effective teaching and learning and supports the growing expertise and innovation of both students and teachers.

K–6; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists

Project-Based and Problem-Based Curricula

Connect Technology and School Improvement: Project-Based Learning in the Classroom

Denise Schmidt, Iowa State University, Chris Milner, Vaughn Murphy, Christine Michelini, Deb Versteeg

Room: S104

Transform your classroom into a project-based learning environment where students are actively engaged in meaningful tasks. Teachers and others will share a framework and resources for transferring this model.

K–8; Teachers, Technology Coordinators, Staff Developers, Administrators; NETS•S: 3–6; NETS•T: II, III

Distance/Distributed Learning

Hawaii's E-charter School: Bring It On(line)

Laura Tamura, Hawaii's E-School, Ronni Adams, Brent Kiyan, Soo Boo Tan

Room: S404d

Hawaii's E-charter School is successfully ushering in a new environment for teaching and learning as well as reforming the traditional school system.

9–12; Teachers, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators

Literacies for the Information Age

Information Literacy in the Internet Age: A Progress Report

Gertrude (Trudy) Abramson, Nova Southeastern University (FL), George Fulmer

Room: S403b

What exactly is information literacy in 2001? Learn about current national and global educational initiatives. Find out how to join the bandwagon.

K–12, University/College, Community College Teachers, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators; NETS•S: 5

International Computer Driving License (ICDL) Certification Program Overview

Gary Gaye, Association For Computing Machinery (NY)

Room: S101b

The mission of the ICDL Program is to provide every individual with computer literacy training and qualifications required to participate in a global digital society.

6–8, University/College, Community College Teachers, Technology Coordinators, Staff Developers, Library/Media Specialists, Administrators

PAPERS

Two papers per one-hour session.

UCI Computer Arts: Building Gender Equity While Meeting ISTE NETS

Kimberly Bisbee Burge, University of California–Irvine (CA)

Room: S304a

UCI Computer Arts tutoring builds gender equity through multimedia and the Web, engaging elementary students in academic learning, research, presentation, and university experience while fulfilling ISTE NETS.

4–6; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators; NETS•S: 1–6; NETS•T: I, II

Foster Girls' Computer Literacy through Laptop Learning

Heike Schaumburg, Freie Universität Berlin (Germany)

Room: S304a

Hear findings reported on the development of computer literacy of boys and girls in a laptop program.

University/College; Teachers, Technology Coordinators, Administrators

TUESDAY, 5:45–6:45 PM

BIRDS-OF-A-FEATHER SESSIONS

***Learning & Leading with Technology* Authors Past, Present, and Future Meet, Greet, and Eat**

Kate Conley and Anita McAnear

Room: N420a

Technology Coordinator Sharing

David Ellison

Room: S101a

FileMaker Pro™ on the Web

Andrew MacKenzie

Room: S301b

Get Ready—Get Set for UB Studio.net Arriving 2001

Anthony Malone

Room: S102a

Internet Safety/Policies

Cheryll McConnell

Room: S102b/c

Helping Seniors Feel Comfortable in the Information Age

Al Mizell

Room: S102d

Designing/Building/Maintaining/Upgrading the Network

John Mundt

Room: S103a

Tech Access: Expanding the Network and Efforts of Passionate Teachers Changing Students' Lives through Technology

Marge Nanny

Room: S103b/c

Delivering Student Achievement Data to Teachers' Computer Desktops

Lynn Ochs

Room: S105a

Use of Robotics as an Instructional Tool

Tim Phillips

Room: S105b/c

Wireless Wide Area Networking

Larry Schlecher

Room: S105d

Using E-mail Resources

Liz Seaton

Room: S401d

Using Unix in High Schools (Programming, Computer Science, Servers, etc.)

Edward Siegfried

Room: S402

Education Portals

Diana Skinner

Room: S404a

Library Media Specialists

Donna Steffan

Room: S404b/c

Help Desk in Schools

Doug Thompson

Room: S404d

International Kidlink

Laurie Williams

Room: S405a

The Digital Divide Discussion List

Andy Carvin

Room: S301a

Equity and Access Issues on Learning Technologies

Manorama Talaiver

Room: S301d

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WEDNESDAY KEYNOTE, 8:30–10 AM

GENERAL SESSION HALL B1

HILARIE DAVIS

WITH ANGELA CRISTINI, NAN LOMBARDO, ALEXSIS MORAN, DEBORAH PEAK-BROWN, AND EDIE THAYER

Stories from the Field: Building the Wisdom of the Community

As technology grows in speed and power, so do we gain an understanding of how it helps us reach higher and delve deeper. Through the stories we tell ourselves and each other, we learn how to make technology make a difference in our lives—in the way we communicate, the way we learn, and the way we build knowledge together. In this multimedia keynote, you will hear about the power six individuals have found in their thoughtful use of technology. They will share their struggles, power tools, and most burning questions. Learn how to tell your story and add your voice to the conversation.

WEDNESDAY, 10 AM–12 NOON

STUDENT SHOWCASE

All Showcases are located in the Vista Ballroom Lobby.

Book Bites

Karen Conner, Chapman Elementary School (AL), Ken Michael, Jared Brown, Katie Merring, Will Conner, Stephen Brown

Table 1

Through the use of HyperStudio®, students were able to build multimedia commercials advertising their favorite books. This program was used in conjunction with the school library.

K–6; Teachers, Technology Coordinators, Library/Media Specialists, Administrators

Developing Youth Technology Leaders: A Primer for Addressing the Digital Divide

Edison Freire, School District of Philadelphia (PA), Darryl Mighty, Giovanni Reyes, Bao Tran

Table 3

A discussion of Web design services and technology support provided by Philadelphia, Pennsylvania, high school students to community agencies and schools will be followed by a hands-on session to teach attendees the basics of Web page design, offering a practical demonstration of how technology and service learning can be used to create meaningful educational opportunities for urban students.

9–12

The Adventure Agent Technology Club

Janet Johnson, Atlanta Public Schools (GA)

Table 2

Meet this year's Adventure Agent Technology Club members as they share highlights of current fact-finding missions conducted using available technologies in their schools.

K–8; Teachers, Technology Coordinators

POSTERS

Weaving Our Way

Valerie Becker, West Tisbury School (MA), Martha Stackpole

Table 6

Learning has come alive for children, and a variety of media will inform participants. Receive handouts, information on tools, instructions for their use.

K–8; Teachers, Technology Coordinators, Staff Developers, Administrators; NETS•S: 1, 3–6

Trails Project Cyberneers: Integrating Technology with History

Joe Glotzbach, Council Grove High School (KS), Judson Barbara, Sheila Lithe, Mae Thomas

Table 5

View designs for old-fashioned activity cards with a digital twist. Historical research projects presented in a multimedia format can give life to history.

4–12; Teachers, Technology Coordinators, Staff Developers, Library/Media Specialists, Administrators

Teachers Teaching Teachers

Marge Hirschfeld, The Challenge Grant: The Consortium Project (NE), Stacy Van Borkum

Table 3

Find out about the format of a workshop that involves teachers helping teachers improve teaching through technology integration, lesson design, and brain research.

6–12; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Administrators

Thin Clients Versus Network PCs in a K–12 School

Suzanne Hoffmann, Sanford School (DE)

Table 11

Considering thin clients instead of network PCs? Check out Sanford School's results after a year of testing both on our campus network.

K–12; Teachers, Technology Coordinators, Library/Media Specialists, Administrators

Headed for the Future with My Résumé on the Web

Becky Hutchins Napoli, Bonny Eagle Middle School (ME), Andrea Tucker Merrifield

Table 9

Students build Web pages that reflect their interests, achievements, and hopes for the future. Explore the Career Futures, student résumés, and a template for your own portfolio.

6–12; Teachers, Staff Developers; NETS•S: 1–3, 6

Explore the World with Radios: Wireless Technology without Computers!

Anton Nimm, Central New York Regional Information Center, Jim Kohl

Table 12

Radios integrate curriculum and teach listening skills, social studies, science, math, and foreign languages. AM/FM, weather, shortwave, and amateur radios connect learning to standards for technology.

4–12; Teachers, Technology Coordinators, Staff Developers, Library/Media Specialists; NETS•S: 1–6; NETS•T: I–V

TEAMS Distance Learning: Improving Instruction through Distributed Learning

Richard Napoli, Los Angeles County Office of Education (CA), Gayle Perry

Table 7

TEAMS Distance Learning involves classrooms across America in a unique model based on hands-on, meaning-centered instruction that emphasizes communicating, thinking, and understanding.

K–8; Teachers, Technology Coordinators, Staff Developers, Library/Media Specialists, Administrators

Strategies for Learning in Online Environments

Joan Whipp, Marquette University (WI), Heidi Schweizer

Table 4

Hear results of a study of learning and motivation strategies used by students to cope with the unique challenges of the online environment.

6–12, University/College, Community College; Teachers, Teacher Educators, Staff Developers, Administrators

Celebrate Mardi Gras with Digital Platforms

Yixia Zhang, McNeese State University (LA)

Table 1

Hear one educator's experience in teaching students to design and develop digital platforms celebrating and preserving the local culture's uniqueness.

K–12, University/College, Community College; Teachers, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators

WEB POSTERS

USA TODAY Provides Customized Online Learning for Educators

Jamie Patton, USA TODAY (VA)

Table 13

Preview *USA Today's* new customized online learning tool designed to help educators connect students daily to the events that shape our world. *(Exhibitor Presentation)*

4–12, Community College; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators

South Carolina Center of Excellence and PT³ Project Jericho

William Fisk, Clemson University (SC), Lynn Nelson, Chris Peters

Table 22

Gain increased knowledge of resources and collaborative opportunities related to integrating technology into teaching and learning.

K–12, University/College; Teachers, Teacher Educators

Going GLOBAL: Learning Science While Doing Science Using the Net

Vicki Hamrahan Alsalia, Georgia Tech Research Institute, Claudia Huff, Nancy Hanham, Jennifer Locken (AL)

Table 16

Looking for a meaningful use of the Internet to support science and math learning in your classroom? Learn about GLOBE!

K–12; Teachers, Technology Coordinators

WEDNESDAY, 10 AM–12 NOON CONTINUED

WEB POSTERS CONTINUED

Effectively Integrate Existing Web Sites into a Traditional Curriculum

Michelle Heist, Parkland High School and Lehigh University (PA), Alec Bodzin

Table 16

This Web poster session will demonstrate how to effectively integrate existing Web sites into a traditional science curriculum while helping them meet national standards.

6–12; Teachers

Attain Information Age Computer Literacy Using an Online Text

Marilyn Kemp, Columbia College Chicago (IL), Rebecca Courington, Jill Davis, Tim Mayfield, Bob Nemenshoneder

Table 17

Our students are arts oriented and multicultural, with a wide range of learning styles and skill levels. An online text keeps everyone involved and focused.

9–12, University/College, Community College; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators

The 3 E's: Engaging, Enriching, and Exciting!

Sandra Lisschen, Belle Valley SD #119 (IL), Susan Creighton, Jan Finch

Table 20

Come see how three teachers effectively integrate technology into the primary curriculum to make it more exciting, engaging, and enriching!

K–3; Teachers, Technology Coordinators, Teacher Educators

Supercharge Your Math or Science Instruction Using the Internet

John MacDonald, Burke County School System (GA), Debbie MacDonald

Table 18

Use the Internet in your classroom to supercharge your math and science instruction. Benefit from a workshop that is lasting and continual.

General; Teachers, Technology Coordinators, Teacher Educators, Staff Developers

Web-Based Mentorship: Professional Development Environments for Preservice—Expert Educators

Kathryn Morgan, Bemidji State University (MN)

Table 15

The mentorship site is an environment of Web content, links to resources, and real-time discussion forums that link users to local and national expert mentors.

General; Teachers, Technology Coordinators, Teacher Educators, Administrators

Scaffolding Web-Based Courses

Dee Rice, Lamar University (TX), Craig Pember

Table 24

Design and delivery of Web-based courses will open whole new perspectives in content delivery. This session should help make the task easier.

9–12, University/College, Community College; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Administrators

Use the Online Community Starter Kit as an Interface to Build Repositories of Learning Objects

Jeff Sale, NPACI Education Center on Computational Science and Engineering (CA), Kris Stewart, Mikhail Berstein

Table 21

Learn about the Online Community Starter Kit, a toolkit/template for creating an educator-oriented community and database repository to share and evaluate high-quality instructional learning objects.

9–12, University/College, Community College; Teachers, Technology Coordinators, Staff Developers, Library/Media Specialists

Curriculum Online: Matching the Internet to Curriculum

Barbara Schulz, Bonnaine-Publishing, Ltd. and University of Maryland

Table 14

Does cyberspace have too much information to sort? Expeditions Online links safe online activities to common curriculum units for intermediate grades.

4–6; Teachers, Technology Coordinators, Teacher Educators, Staff Developers; NETS•S: 3–5; NETS•T: ii, iii

The TRIBE Web: Technology Resources in Bilingual Education

Lorraine Smelin, University of Illinois–Chicago, Kimberly Lawless

Table 23

Learn about the TRIBE Web site and gain access to its fund of quality ideas that you can implement within your own settings.

K–8; Teachers, Technology Coordinators, Teacher Educators

WEDNESDAY, 10:30–11:30 AM

★ SPOTLIGHT SESSIONS

Teaching and Learning Online: Professional Development Opportunities

Donna Baumbach, University of Central Florida, Mary Bird, Janet Bateman, Kathy Katz, Holly Ledgate

Room: S402

Today, many teachers are learning through anytime/anyplace staff development components. What lessons have we learned from these teachers, the component developers, and the course facilitators?

General; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators

Online Professional Development: Meeting the Standards

Joellen Killion, National Staff Development Council (CO), Marilyn Schlief (DC)

Room: S103a

The National Staff Development Council has established standards for professional development. Examine how those standards apply to online professional development.

General; Teachers, Technology Coordinators, Staff Developers, Administrators

Beyond Information Power

Jamie McKenzie, From Now On—The Educational Technology Journal (WA)

Room: Vista Ballroom (S406a)

Hear strategies to prepare students to create new ideas skillfully, resourcefully, and imaginatively. Take students beyond the collection of others' best thoughts and the reporting of conventional wisdom.

E-learning: The Impact of the Internet on Higher Education

Burks Oakley, University of Illinois

Room: S101a

Find out about e-learning. See a demonstration of pedagogically effective techniques and tools.

University/College, Community College; Teachers, Technology Coordinators, Staff Developers, Administrators

Revolutionizing Science Teaching with Atomic Scale Models

Robert Tinker, The Concord Consortium (MA), Boris Berenfeld

Room: Vista Ballroom (S406b)

Atomic phenomena from temperature to osmosis emerge from new atomic-scale models. By exploring and building these models, students learn fundamental science concepts in early grades.

6–12, University/College; Teachers, Technology Coordinators, Teacher Educators, Staff Developers

BUILDING TECHNOLOGY CAPACITY

Mine the Technology Mother Lode: Small Grants

Loraine Chapman, Arizona Department of Education (AZ)

Room: S106d

Million dollar grants are so competitive, but you can hit pay dirt with small grants. Need help? We'll explore good-as-gold Internet grant sites.

K–12, University/College, Community College; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators

Use the Internet Safely in Schools

Paul Johnson, Rantoul High School District 220 (IL), Karin Schmidt

Room: S404d

Learn strategies and solutions for ensuring the safe use of Internet access in elementary and secondary classrooms.

K–12; Teachers, Technology Coordinators, Administrators; NETS•S: 2, 5, 6

BUILDING HUMAN CAPACITY

Professional Development

Spin the SEIR*TEC Professional Development Wheel for Successful Technology Integration

*Margaret Bingham, SEIR*TEC at SERVE (NC), Elizabeth Byrom*

Room: S103d

Tired of enduring the same old type of professional development on technology? Learn about models that are fun and result in effective technology integration.

General; Teachers, Technology Coordinators, Staff Developers, Administrators; NETS•T: ii

Practical Strategies from Four Years of Online Staff Development

Cheryl LaMaster, Naperville North High School (IL), Laurie Mangel, Sharon White

Room: S405b

Learn strategies you can put to immediate use in your online programs about topics such as effective chats, orientation, attrition, procrastination, team teaching, and assessment.

K–12, University/College, Community College; Technology Coordinators, Teacher Educators, Staff Developers, Administrators; NETS•T: i–vi

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Preservice Teacher Preparation

A National Perspective: Preparing Tomorrow's Teachers to Use Technology (PT³)

Tom Carroll, PT³ Program of the U.S. Department of Education (DC), Don Knezek, Lorraine Gross, William Callahan (IA), Heidi Rogers (ID)

Room: [illegible]

Get updates from ISTE's National Center for Preparing Tomorrow's Teachers to Use Technology (NCPT³), the PT³ Coordinating Council, and the U.S. Department of Education PT³ Program Staff. (Sponsored by ISTE)

General; Teachers, Technology Coordinators, Teacher Educators, Administrators; NETS•T: I–VI

Online Student–Teacher Supervision with WebCT™: A SUNRAY Project

Nancy McClure, Fairmont State College (WV), Philip Berryhill, Carolyn Crislip-Tacy, Kristi Klein, Christine Lemasters, G.H. "Buck" Sapp

Room: [illegible]

Panelists will explain and demonstrate how they are using WebCT to enhance clinical supervision of student teachers. Panelists will share development process, protocol, and results.

University/College, Community College; Teachers, Teacher Educators; NETS•T: V

Annual Research Award on Technology and Teacher Education: "Beginning to Put the Pieces Together: A Technology Infusion Model for Teacher Education"

Dale Niederhauser, University of Utah, Arlene Borthwick (IL); winners: Rachel Vannatta (OH), Blanche O'Bannon (TN)

Room: [illegible]

Interested in leading-edge research on the role of technology in teacher education? Come to this session to hear top papers from this year's ISTE SIGTE Research Award on Technology in Teacher Education competition. (Sponsored by ISTE's SIGTE)

University/College; Teachers, Technology Coordinators, Teacher Educators

BUILDING A LEARNING ENVIRONMENT

Early Childhood/Elementary

Let's Read! Create Digital Books to Develop PK–2 Math Concepts

Trena Wilkerson, Baylor University (TX), Leah Oldfield

Room: [illegible]

Reading, technology, and mathematics come together! See counting, shapes, and more through the creation of digital books in PK–2.

K–3, University/College; Teachers, Teacher Educators, Library/Media Specialists; NETS•S: 3, 5; NETS•T: II, III

Math/Science

Understand and Enjoy Math through Interactive Software

Rudy Neufeld, Neufeld Learning Systems Inc (ON, Canada)

Room: [illegible]

We will use interactive software and worksheets to show how technology enhances, expands, and embraces the math curriculum. We will provide a CD and worksheets. *(Exhibitor presentation)*

Teachers

Build the Future Today! Technology Helps Everyone Succeed in Algebra

Robyn Silbey, Montgomery County Public Schools (MD)

Room: [illegible]

Through visual aids and demonstrated hands-on activities, participants will discover how technology enables students to successfully master algebra through the magic of multiple intelligences.

6–8; Teachers, Technology Coordinators, Administrators

Multimedia/Virtual Reality

Virtual Voyage: Bringing Virtual Reality into the Classroom

Scott Schoenfeld, Calcasieu Parish Schools (LA), Lisa Nolin, Pam Nicholson

Room: [illegible]

Discover how virtual reality (VR) technologies can be used in the classroom. See demonstrations of VR technologies and their integration into the curriculum, particularly science.

4–12; Teachers, Staff Developers, Library/Media Specialists

Internet/Web

FieldQuestLive: A Collaborative Distance Learning Project

William DeLamater, Windwalker Corporation (VA), Sherry Ward

Room: [illegible]

Learn how to use wireless technology to help your students research and present live, interactive Webcasts from your community to their peers nationally.

6–12; Teachers, Technology Coordinators, Library/Media Specialists, Administrators

Optimize Web Pages for Instruction

Tim Dirks, Institute of Computer Technology (CA)

Room: [illegible]

Learn 10 important optimizing techniques that successful Web designers use when creating Web pages for readability and functionality.

4–12, University/College, Community College; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators; NETS•S: 1, 3, 4; NETS•T: I, II

Technology Integration

Introducing the California Learning Resource Network (CLRN)

Bridget Foster, California Learning Resource Network, Sandra Bandick

Room: [illegible]

CLRN provides educators with a one-stop resource to select electronic learning resources that meet instructional needs and implement the California curriculum frameworks and standards.

General; Teachers, Teacher Educators, Library/Media Specialists, Technology Coordinators/Administrators/Staff Developers

NCREL's Learning with Technology: Building a Brighter Future

Beverly Hart, Flanagan High School (IL)

Room: [illegible]

Discover how the practical application of NCREL's "Learning with Technology" model can energize students and teachers to collaborate on learning activities and projects in the e-classroom.

6–12, University/College, Community College; Teachers, Technology Coordinators, Staff Developers, Administrators

Digital Readiness: Establishing New Learning Environments

Roxana Van Fleet, Electronic Education (AZ), Steve Matthews (CA), Douglas Brown (PA)

Room: [illegible]

Schools are at the vanguard of technology, state-of-the-art networks, new computers, and high-speed Internet access. Next step—on-demand digital multimedia. *(Exhibitor presentation)*

K–6; Teachers, Technology Coordinators, Staff Developers, Library/Media Specialists, Administrators

Literacies for the Information Age

CyberSavvy: Preparing Kids for the Information Age

Kellie Dunlap, Plainfield Community Consolidated School District 202 (IL)

Room: [illegible]

Come see what we've done to prepare our elementary students for the information age! Creating cybersavvy students takes less time than you think!

K–6; Technology Coordinators/Administrators/Staff Developers, Library/Media Specialists, Teachers; NETS•S: 1–6

Build Tomorrow's Information Research and Management Skills

Marilyn Ostmann, Britannica.com Inc (IL)

Room: [illegible]

Lost in the Internet's vast array and reliability of information? Learn the most effective student skills and instructional models for Internet-based research using BritannicaSchool. *(Exhibitor presentation)*

6–12, University/College, Community College; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators

Which Is Better ... Screen A or Screen B?

Tamara Wallace, Findlay High School (OH); Michael Wallace

Room: [illegible]

Join dueling laptops in a heated debate over visual design principles. We challenge you to create desktop materials that are more professional, polished, and pleasing.

General; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators

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WEDNESDAY, 10:30–11:30 AM CONTINUED

Student Assessment

Evaluating Student Computer-Based Products

Bernajean Porter, Education Technology Planners, Inc. (CO), Annette Lamb, Kristen Colopoulos, Cyndie McCarley

Room: S10?

This session will introduce a new set of comprehensive student product evaluation tools developed by NCRTEC and NCREL in partnership with education technology planners and and national consultants.

K–12; Teachers, Teacher Educators, Library/Media Specialists, Technology Coordinators, Administrators, Staff Developers

Laptop Learning

Pedagogical Readiness for a Laptop Environment

Jeanne Giddings, Atlanta Girls' School (GA), Jennifer Bates, Allen Broyles

Room: S101b

Learn how one all-girls school used gender research, curriculum integration, and student information management needs to drive the design of a wireless, all-laptop network.

6–12; Teachers, Technology Coordinators, Library/Media Specialists, Administrators

Cyber Learning and Student Achievement: An eSchool Model

Audrey McMahon, Ridge View High School (SC), Chuck Holland, Tom Cramer

Room: S404d

Learn about a replicable plan for the implementation of global communications–based learning environments to meet the demands of students and parents and the needs of the community.

9–12; Teachers, Technology Coordinators, Staff Developers, Administrators; NETS•S: 1–6; NETS•T: i–vi

PAPERS

Two papers per one-hour session.

Adapt Online Education to Different Learning Styles

Diane Muir, Intelligent Education, Inc. (GA)

Room: S304a

Discuss how online learning courseware and technology can be adapted to different learning styles to best accommodate lifelong learning.

General; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators

Style and Instructional Design in Online Learning Environments

Len Quiñodoz, Washington State University (WA), Abbie Brown

Room: S304a

Discuss the teaching challenges and benefits for an online instructional design course, focusing particularly on how teaching styles are used to enhance learning outcomes.

University/College, Community College Teachers, Teacher Educators, Staff Developers, Administrators; NETS•T: ii, iv

WEDNESDAY LUNCHEON KEYNOTE 11:45 AM–1:15 PM

GRAND BALLROOM S100a/b

DEBBIE SILVER

In this lively, humorous presentation, Dr. Silver will demonstrate ways to go beyond traditional instructional strategies that are fun and rewarding for both the students and the teachers. Be prepared to laugh, to learn, and to think about those learners who "march to the beat of a different drummer." For most of her teaching career, Dr. Silver's primary education focus has been middle school science. She is an award-winning educator whose sense of humor and message will entertain, delight, and inspire you.

WEDNESDAY, 12 NOON–1 PM

★ SPOTLIGHT SESSIONS

A Range of Use

Cheryl Lemke, Metiri Group (CA), Ed Coughlin

Room: Vista Ballroom (S400b)

Ensure your students a full range of technology applications—in contexts that bring the best out of both.

General; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators; NETS•S: 1–6; NETS•T: ii–iv

Overcoming the Digital Divide

Craig Luigart, U.S. Department of Education (DC), Don Barrett, Alan Kandry, Jan Tharl

Room: S501a/c

Attend this inspirational speech on the importance of inclusive technology by Craig Luigart, Chief Information Officer of the U.S. Department of Education.

General; Teachers, Technology Coordinators, Administrators

Supporting School-Based Learning and Teaching with Advanced Visualization Technologies

Tom Moher, University of Illinois–Chicago, Victor Bass, Carol Dudzik, Marilyn Rochowicz

Room: [illegible]

Learn how emerging display technologies might affect inquiry learning and teaching in elementary schools in this collaborative project involving university researchers and elementary school teachers.

K–8; Teachers, Technology Coordinators, Library/Media Specialists, Administrators

BUILDING A FRAMEWORK

The Supreme Court Is in Session: Ask the Experts

Larry Anderson, National Center for Technology Planning (MS), Sara Armstrong (CA), Andy Carvin (DC), Al Rogers (CA), Margaret Honey (NY), Ron Jackson (CA), Jenelle Leonard (DC)

Room: Vista Ballroom (S400a)

Premiere leaders of technology gather in one place so you can ask them your burning questions. Join us and discuss today's most critical issues!

General; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators

The Programming Imperative: The Case for School Computing

Gary Stager, Pepperdine University (CA), Adam Smith, Linda Polin, Michael Quinn (Canada), Sean Perloff (CA), Marian Rosen (MO), David Dinsey (Australia), Steve Costa (Australia)

Room: S304b/c

Politicians, educators, employers, and parents bemoan the lack of skilled workers to fill high-paying technology jobs. Computer programming instruction could easily solve this problem. (Sponsored by ISTE's SIGLogo)

General; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Administrators

BUILDING HUMAN CAPACITY

Professional Development

The Classroom Technology Program: A Comprehensive, Collaborative Staff Development Model

Barbara Bellanti, Widener University (PA), Joseph Bellanti, Thomas Dinardo

Room: S100a

Learn step-by-step how to effectively (and cost effectively!) develop a technology staff development program that successfully prepares teachers to integrate technology into the curriculum.

University/College Teachers, Technology Coordinators, Staff Developers, Administrators; NETS•T: [illegible]

Cincinnati Public Schools Technologist/Intern in Residence Program

Gini Brumh, Cincinnati Public Schools (OH), Dave O'Laughlin, Jackie Snead

Room: S405b

Learn how Cincinnati solved professional development challenges by bringing a laptop lab, an educational technologist, and a high school intern to its schools for a week of customized training.

General; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators

The Online Professional Development Market: How Stocked Are Your Shelves?

Joyce James, ALTec, University of Kansas

Room: S100a

Bombarded by online professional development options? Latch on to this development matrix that offers team-based processes and design requirements to grow online learning experiences throughout the organization.

General; Technology Coordinators, Staff Developers, Administrators; NETS•T: i–vi

Lessons Learned from the Digital Tools Project in Washington State

Oddmund Myhre, Western Washington University, David Tucker, Tony Jongejan, Tim Kuiper, Jane Dodd

Room: S100d

Ready for a digital curriculum? See a model for involving teachers in rural and low-income schools in project-oriented teaching and technology integration.

K–12; Teachers, Technology Coordinators, Staff Developers, Administrators

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Professional Development, Continued

Relevant, Practical, Proven Professional Development in Technology Integration

Dianne Pepper, Educational Resources (OH), Dian Robbins (NC)

Room: S404d

Leave with strategies for successful professional development in the integration of technology based on the research of experts and experience of the presenters. *(Exhibitor presentation)*

General; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators

Preservice Teacher Preparation

Integrating New Technologies into the Methods of Education: A PT³ Catalyst Grant

William Callahan, University of Northern Iowa

Room: S501d

Consider how to use online video case studies of PK–12 teachers using technology in educational environments to prepare tomorrow's teachers to use technology.

K–12, University/College, Community College; Teachers, Teacher Educators, Administrators; NETS•T: ii, iii

TechDay in Paradise: Creating a Technology-Enhanced Learning Environment

David Hoflich, University of Nevada–Las Vegas, Paulette Burns

Room: S501a

TechDay is an innovative effort to enhance the capacity of school faculty to mentor preservice teachers in the use of technology in teaching.

General; Technology Coordinators, Teacher Educators, Staff Developers, Administrators

Leadership and Competencies, Standards, and Certification

Prepare Technology Leaders for America's Schools: New ISTE/NCATE Accreditation

Lajeane Thomas, Louisiana Tech University, Joyce Friske (OK), Heidi Rogers (ID), David Barr (IL)

Room: S504d

Drafts of revised ISTE/NCATE accreditation standards for teacher preparation programs preparing district- and building-level technology leaders will be presented and feedback for refinement solicited. (Sponsored by ISTE)

General; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators

BUILDING A LEARNING ENVIRONMENT

Early Childhood/Elementary

Can Second Graders Create and Edit Videos?

Kathy Sanders, Taylor Prairie School (WI), Jeanell Dailey, Jill Jonsson, Stephen Sanders

Room: S404b/c

... and why would you want them to? Hear the retelling of our journey into reading, technology, and the unknown.

K–3; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators

Language Arts/Social Studies

Your Genes, Your Choices: An Online Reading and Study Environment

Mark Horney, University of Oregon, Carol Kennedy (NY)

Room: S401d

Learn how to use new electronic books that support comprehension and teach new reading skills while students read abou cool stuff such as human cloning.

6–12; Teachers

Romantic Circles High School: A Student-Built Collaborative Learning Environment

Steven Jones, Loyola University Chicago (IL), Candace Katz, Paul Martin

Room: S405a

Find out about this nationwide online learning community built by students and teachers in this live demo and team lecture on the NEH-funded Romantic Circles High School project.

9–12, University/College, Community College; Teachers, Teacher Educators, Library/Media Specialists, Administrators

Math/Science

Online Microscopes and Inquiry-Based Science Instruction: Improving Science Teacher Education

Connie Hargrave, Iowa State University, Tom Andre, Scott Chumbley, Kristen Constant

Room: S103b/c

Scientists and educators are using an online scanning electron microscope to create learning experiences that develop preservice teachers' science inquiry, problem-solving, and technology skills.

6–8, University/College, Teachers, Teacher Educators; NETS•T: i, ii

Special Populations

The Other Side of Literacy

Terry Laskaris, disABILITY Resources (MT)

Room: S404a

There is more to reading than phonics and comprehension. Emotional intelligence, the theory of the "Boy Code," and other factors contribute to students' reading abilities.

General; Teachers, Technology Coordinators, Teacher Educators, Administrators

Multimedia/Virtual Reality

HyperQuests: Create Interactive Internet Activities

Jim Hirsch, Plano ISD (TX)

Room: S105a

Learn how you can easily create exciting, interactive multimedia activities called HyperQuests for student use in the classroom and on the Internet.

Teachers, Technology Coordinators, Staff Developers

Internet/Web

Web Activities to Energize Teaching and Learning

Mary Kreul, Richards Elementary School (WI), Jeff Widder, Marie Widder

Room: S101a

Discover exciting Web sites and telecollaborative activities that can be successfully integrated into your K–6 curriculum and used to enhance curricular goals.

K–6; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators; NETS•S: 1, 2–4; NETS•T: i–iv

Technology Integration

Technology Integration Experiences: Tying Standards, Assessments, and Accountability into Curriculum

Sue Burch, Grand Island Public Schools (NE)

Room: S102b/c

Discover how to write standards-based lessons infused with technology and complete with student assessments. Learn how to measure student and staff technology growth.

General; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators

Computers Can't Teach

Terry Tamblyn, Community Consolidated School District 180 (IL)

Room: S105d

It's easy to buy the hardware and software. It's harder to maintain the system. But the key is how it fits into teaching and learning.

General; Technology Coordinators, Staff Developers, Administrators

Problem Solving and Critical Thinking and Cooperative/Collaborative Learning

60 Ideas in 60 Minutes

David Allitson, Apple Computer Australia (Victoria)

Room: S102d

There are millions of Web sites, and they all sound as if they are exactly what teachers need. Find out about a few you can't do without.

General; Teachers

Literacies for the Information Age

Transform Libraries and Learning for the Future

Kristen Campton, Follett Software Company (IL), Cynthia Kiefer

Room: S105b/c

Explore trends driving technology and educational reform in schools, learning, and libraries. What are these new learning environments? How have learner and teacher roles changed? *(Exhibitor presentation)*

K–12; Teachers, Technology Coordinators, Library/Media Specialists

Great Educational Resources That Search Engines Miss

Ken Wiseman, High School District 214 (IL)

Room: S106

Search engines can miss important and educationally relevant Web resources. Learn some solutions and find out about links and alternative search tools.

General; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators

Student Assessment

Develop Authentic Assessment Tools for Classroom Use

Carol Shields, Fort Worth ISD (TX), Mahlon Tate

Room: S101b

How do you turn applied learning activities into grades? Authentic assessment tools! View samples of authentic assessment tools developed by students and teachers for classroom use. Then develop your own.

K–12; Teachers; NETS•T: iv

WEDNESDAY, 12 NOON–1 PM CONTINUED

BUILDING EQUITY AND ACCOUNTABILITY

Young Women's Leadership Charter School: Building Technology Skills through Partnerships

Suzanne Pink, The Young Women's Leadership Charter School of Chicago (IL), MaryAnn Pitcher, Margaret Small

Room: S505a/b

Learn how The Young Women's Leadership Charter School of Chicago partners with area organizations to enhance and enrich its math, science, and technology-focused curriculum.

6–12; Teachers, Technology Coordinators, Administrators

Assuring Quality in Learning Technology Assessment

Kirk Vandersall, Metiri Group (CA)

Room: S104

Explore proven strategies for assuring that both external and locally developed assessment and evaluation instruments and processes are of the highest possible quality.

General; Technology Coordinators, Administrators

PAPERS

Two papers per one-hour session.

Computer Scaffolding and Disciplined Inquiry in the Social Studies Classroom

Robert Bain, University of Michigan (MI), Stephen Mucher, Minus Lee

Room: S504a

Explore the principles, problems, and possibilities of computer-aided scaffolding as part of a discipline-based approach to history and social scientific learning in secondary classrooms.

9–12, University/College, Community College; Teachers, Technology Coordinators, Teacher Educators

From Mythology to Technology: Sisyphus Makes the Leap to Learn

Patricia Dunbar, NatureShift Project, Dakota Science Center (ND), John Hoover, Mary Beth Kelley-Lowe

Room: S504a

Still struggling to roll that technology rock uphill? Benefit from the lessons learned about debunking technology myths for educators across the industry and in a variety of environments.

General; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Administrators; NETS•S: 1, 3–6; NETS•T: i–vi

WEDNESDAY, 1:30–2:30 PM

★ SPOTLIGHT SESSIONS

Windows to the World: Teaching and Learning at a Distance

Annette Lamb, Lamb Learning Group (TX)

Room: Vista Ballroom (S406b)

Explore a dozen practical ideas for using Internet as a tool for active learning, creative communication, and authentic information sharing. Open windows to the world.

General; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators

BUILDING TECHNOLOGY CAPACITY

Through the Portal—Where Instruction and Services Meet

Chuck Chalvick, Raritan Valley Community College (NJ)

Room: S504b/c

The use of "portal software" can bring together instructional tools and online services for students and faculty. Find out about an example of this technology. (Sponsored by ACM's SIGUCCS)

General; Teachers, Technology Coordinators, Library/Media Specialists, Administrators

Maximizing Resources for Teaching and Administration: The Schools Interoperability Framework (SIF)

Rachel Haynes, Schools Interoperability Framework (SIF) (DC)

Room: S401d

SIF representatives will share firsthand accounts of seamless interoperability of K–12 software through SIF. Presenters will include technology experts, vendors, and representatives from "showcase sites."

General; Teachers, Technology Coordinators, Library/Media Specialists, Administrators

Technology Support Strategies—Tools for Effective Practice

Chip Kimball, Lake Washington School District (WA)

Room: S105d

The Gates Foundation recognizes the technical support challenges schools face. This project identifies effective strategies and lessons learned, and introduces an interactive tool to help schools.

General; Technology Coordinators, Library/Media Specialists, Administrators

Thin-Client Computing: Expand Access without Breaking the Budget

Shelly Lake, Eyes on the Future (CA), Karen Greenwood

Room: S501b/c

Thin clients make information technology manageable and affordable while improving the classroom experience for educators and students.

General; Technology Coordinators, Administrators; NETS•S: 1–6; NETS•T: i–vi

BUILDING HUMAN CAPACITY

Professional Development

Using Apple's Web-Based Resources for Teaching and Learning

Apple Education Marketing Team (CA)

Room: S404d

Explore the vast resources available on the Apple Learning Interchange and discover examples of best practices among technology-using educators. *(Exhibitor presentation)*

University/College, Community College; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators; NETS•T: ii–vi; NETS•S: i

The TIP Difference: Staff Development that Works!

Deborah Hale, Educational Service District 113 (WA), Cindy Jasper, Tina Mallery

Room: S102d

More than 100 classrooms in Washington State have benefited from the TIP difference in technology integration in the classroom. Learn how to replicate this successful program.

K–12; Teachers, Technology Coordinators, Staff Developers

Blazing Learning Trails: A Professional Development Model to Improve Schools

Marla Harp, Franklin-Williamson Regional Office of Education (IL), Glenda Bequette, Cheryl Patterson-Dreyer

Room: S405b

Blazing Learning Trails marries the best research in professional development with quality curriculum, teaching methodologies, and technology skills. Come hear about this professional development model.

General; Teachers, Technology Coordinators, Staff Developers, Library/Media Specialists, Administrators; NETS•T: i–iv

Co-teaching in the Hessen Model Schools Partnership

Karen McGillivray, DoDDS-Hessen School District (Germany), Gene Knudsen, Elizabeth McNamara (NY), Elizabeth Walker

Room: S103a

Find out about a technique used successfully in the Hessen District to bring professional development with technology into the classroom!

K–12; Teachers, Technology Coordinators, Staff Developers, Administrators; NETS•S: 1, 5, 6; NETS•T: ii, iii

Professional Development, Continued

Mentoring: Build Technology Integration Capacity at Your School or District

Laura Rosa-Hernandez, El Paso Collaborative for Academic Excellence (TX), Cynthia Stout

Room: S102a

How do we make the best use of the time teachers will need to learn how to successfully integrate technology? Explore mentoring and job-embedded training.

General; Teachers, Technology Coordinators, Staff Developers, Administrators; NETS•T: ii, iii, v

Preservice Teacher Preparation

PT^3: Purdue Program for Preparing Tomorrow's Teachers to use Technology

James Lehman, Purdue University (IN), David O'Brien, Jill Lash

Room: S401d

Learn about Purdue's PT^3 project focusing on faculty development, IP-based video connections between the university and K–12 schools, and an emerging e-portfolio system.

University/College; Teacher Educators; NETS•T: i–vi

Preservice Teachers Share Their Skills as Technology Consultants

Anne Porter, Oakland University (MI), Ledong Li, Deborah Clarke, Marie Irons, Dale Hopkins

Room: S501a

Technology-proficient preservice teacher education students serve as long-term personal technology consultants to experienced K–12 and university educators—a technology-supported collaboration model.

University/College; Technology Coordinators, Teacher Educators, Staff Developers, Administrators

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Leadership and Competencies, Standards, and Certification

Assess the Use of Technology in the Classroom

Marjorie DeWirt, SAS in School (NC), Ann Cunningham (NC), Neal Strudler (NV), Dale Niederhauser (UT), Alisa Chapman (NC), Mary McNabb (IL)

Room: S103d

This session will focus on ways to measure preservice and inservice teachers' knowledge. (Sponsored by ISTE's SIGTE)

University/College, Community College; Teachers, Technology Coordinators, Teacher Educators, Administrators; NETS•T: i–vi

BUILDING A LEARNING ENVIRONMENT

Early Childhood/ Elementary

Technology Creates Enthusiasm for Reading!

Paula Yohe, Dillon School District Two (SC)

Room: S104

See how a variety of technologies are used to motivate students to read. Independent research will show how test scores have risen in this award-winning library.

General; Teachers, Staff Developers, Library/Media Specialists, Administrators

Language Arts/ Social Studies

Online U.S. History for Grade 8

Mary Delgado, Milwaukee Public Schools (WI), Char Hartman

Room: S405a

Does an online U.S. history course encourage eighth-grade students to become active learners? Learn the answer to that question and many more.

6–12: Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators; NETS•S: 4, 5

Math/Science

Panoramic PI ... The Melding of Math and Multimedia

Susan Hensinger-Hoff, Germantown Academy (PA), Phy Chestnut

Room: S306a/b

Digital photography promotes an explosion of curricular integration possibilities, even in math. Explore geometry while creating panoramas—and gain problem-solving, computation, estimation, and measurement skills, too!

4–8; Teachers, Technology Coordinators, Teacher Educators

Claymation and Video Production in Science: A Geology Unit

Eve LaMar, Fairfield-Suisun Unified School District (CA), Michelle Labelle-Fisch

Room: S105b/c

Model key concepts in geology using claymation and video. Learn to use digital cameras, camcorders, and software to explain tectonic plates, mountain development, and more.

K–12: Teachers, Technology Coordinators, Staff Developers, Library/Media Specialists, Administrators; NETS•S: 1–4; NETS•T: i–iii, v

Special Populations

Technology Solutions That Work in the Secondary Academic Areas

Scott Marfilius, Milwaukee Public Schools (WI), Diane Retzenski

Room: S404a

Do your students have difficulty expressing thoughts in written form, comprehending because they can't read the text, or completing math problems? Come see the technology solutions.

6–12: Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators

Multimedia/ Virtual Reality

Create CD-ROMs to Enhance Curriculum and Instructional Design

Paul Betts, CCSD #21 (IL), Helene Davitz, Penny Lieberman

Room: S105a

Learn how CD-ROM technology can be used to create and store presentations, curriculum, and instructional materials for direct student and teacher use.

General; Teachers, Technology Coordinators, Teacher Educators, Library/Media Specialists

Internet/Web

Virtual Classrooms: Keeping Students, Parents, and Teachers in the Loop

Scott Anderson, East Jessamine Middle School (KY), Amanda Higginbotham, Jessica King, Jamie Sharp, Scott Curran

Room: S101a

Tired of repeating yourself, digging out work for absentee students, and working at a desk piled with papers? Web-based, student-run virtual classrooms may be the answer.

K–12, University/College; Teachers, Technology Coordinators, Administrators

Telelearning Made Easy

Russell Long (TX), Karen Nejera

Room: S404b/c

How can you design an impressive integrated lesson without spending hours in preparation? Learn telelearning in six easy steps.

K–12; Teachers, Staff Developers, Library/Media Specialists, Administrators; NETS•T: i–vi

101 Ways to Use the Internet in Your Classroom

Corinne Barton, Teacher Created Materials (CA)

Room: S106

Come and learn quick and easy ways to integrate the Internet easily into your classroom! You will learn how to find teacher resources, student resources, view sample classroom-tested lessons, and help your students search the Web safely.

K–12: Teachers, Teacher Educators, Library/Media Specialists

Integrate Technology into Learning Communities: Creating Multiple Workspaces

Barbara Shelly, Syracuse University (NY), Patricia Tinto

Room: S102b/c

Participate in an interactive discussion focused on the replication issues of creating and implementing a Web-accessed database application that extends classroom boundaries and supports learning communities.

4–12, University/College, Community College; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Administrators

WebTools: Managing Your Digital World

Charles Sprandel, Glenbrook South High School (IL), David Jakes

Room: S504d

Explore 10 free Web-based services that improve personal productivity and your ability to use digital content in instruction to improve learning.

General: Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators: NETS•T: i–iii, v

Technology Integration

Construct Fun and Educational Technology Activities with the K–6 Curriculum

Diane Judd, Valdosta State University (FL)

Room: S105b/c

See demonstrations and illustrations of ways to enhance learning by integrating technology into the K–6 curriculum using a constructivist approach. Participate in discussions.

K–6, University/College; Teachers, Technology Coordinators, Teacher Educators, Staff Developers; NETS•S: 1, 3, 5, 6; NETS•T: ii, iii, v

Great Teaching with Digital Cameras

David Wagner, Tech4Learning, Inc. (CA)

Room: Vista Ballroom (S406a)

Digital cameras are immediate, personal, creative, and almost magical. Learn to edit pictures and get lesson ideas and integration strategies to create exciting classroom projects.

(Exhibitor presentation)

K–8: Teachers, Technology Coordinators, Teacher Educators

Literacies for the Information Age

Use Technology Tools to Guide Student Research Projects

Tammy Stephens, The Stephens Group (WI)

Room: S402

Learn how technology tools such as databases, spreadsheets, Inspiration®, and multimedia tools can be used to help students organize, synthesize, and present information.

4–12; Teachers, Teacher Educators, Staff Developers, Library/Media Specialists; NETS•S: 3–5; NETS•T: ii–iv

Laptop Learning

Bring Technology into Your Classroom with Wireless Laptops

Marsha Gladhart, Wichita State University (KS), Howard Pitler, Rick Weaver, Karen Reynolds

Room: S101b

Find out how to use laptops to integrate technology into content area curricula. Learn about equipment and interact with sample lessons.

General; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Administrators: NETS•S: 3; NETS•T: i–iii

PAPER

Teaching and Learning with ICT: Successful Whole School Implementation

Grant Ramsay, Papatoetoe Central School (New Zealand), Anna Shaw

Room: S304a

An opportunity to consider and apply proven processes and practises to successfully implement schoolwide teaching and learning with information and communication technologies.

K–12: Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Administrators

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WEDNESDAY, 3–4 PM

SPOTLIGHT SESSIONS

Embedded Technology: Learning about and with Technology within Everyday Curriculum

Diane Joseph, University of Chicago (IL), Anthony Bryk, Marvin Hoffman, Lee Bradley, Amanda Djibas, Kimberly Rietschel Felbering, Pamela Geyer, Judith Whitcomb

Room: Vista Ballroom (S406b)

See the Center for School Improvement's approach to curricular integration of technology. See strategies and explore them.

K–8; Teachers, Technology Coordinators, Staff Developers, Administrators; NETS•S: 1–6

First Things First—Planning for Student Learning

Jamie McKenzie, From Now On—The Educational Technology Journal *(WA)*

Room: Vista Ballroom (S406a)

Learn about the sequence and strategies to place curriculum standards and student learning at the forefront of planning.

BUILDING A FRAMEWORK

Making It Happen: Managing a Regional Conference

Cort White, DePaul University (IL), James Caristi (IN), Herbert L. Dershem (MI)

Room: S504d

Organizing, planning, and managing a regional conference just takes patience, perseverance, and flexibility. The panelists will share their views and invite yours. (Sponsored by CCSC)

General; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators

BUILDING TECHNOLOGY CAPACITY

Empower Education through Collaborative Learning Technologies

Roberto Bamberger, Microsoft (WA)

Room: S401d

Learn how technology can help schools build collaborative learning environments that scale from flexible ad-hoc team collaboration to campuswide knowledge sharing and online learning systems powered by the latest Microsoft products including Encarta Class Server and Office XP. *(Exhibitor Presentation)*

K–12, University/College, Community College; Technology Coordinators, Administrators

Outsourcing Everything: Application Service Providers in Education

Todd McIntire, LearnNow, Inc. (NY), Don Liljedahl (MN)

Room: S501b/c

Application service providers (ASP) are challenging schools to give up their servers and outsource mission-critical systems. Is this progress or a slide back to the mainframe age? Review the costs and benefits of the ASP model.

K–12; Technology Coordinators, Administrators, Staff Developers; NETS•T: i, iv, v

BUILDING HUMAN CAPACITY

Professional Development

The Best Free Resources on the Web for Professional Development

Robert Dambe, The Center for Teaching and Learning (IL)

Room: S105d

The Internet really is linking a global community of learners! We'll share the free Web-based tools and resources that make our comprehensive professional development curriculum sparkle!

K–12, University/College, Community College; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators

Threefold Partnerships for Improving English and Mathematics Education with Technologies

Jim Levin, University of Illinois–Urbana-Champaign, Nanette Mellen, Judy Fuhrmeier, Renee Clift, Bridget Arnold, Sheryl Benson, Dennis Baron, Lisa Bievenue

Room: S501d

The IPLP/METER Project is developing and evaluating innovative threefold technology-supported partnerships among high school English and mathematics classes, university teaching methods classes, and content classes.

9–12, University/College, Community College; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Administrators

Preservice Teacher Preparation

Use Performance Assessment to Authenticate Teacher Candidates' Technology Proficiency

Steven Mills, University of Kansas, Steven Scott, Brenda Frieden, Robert Stokes

Room: S501e

Web-based performance assessment is used in this teacher preparation program to authenticate the technological proficiency of teacher candidates, university faculty, and K–12 cooperating teachers.

K–12, University/College; Teachers, Technology Coordinators, Teacher Educators, Administrators; NETS•T: i–vi

Leadership and Competencies, Standards, and Certification

New ISTE/NCATE Secondary Computer Science Education Accreditation Standards

Lapene Thomas, Louisiana Tech University, Harriet Taylor (VA), James Wiebe (CA)

Room: S101b

Drafts of the revised ISTE/NCATE accreditation standards for teacher preparation programs preparing secondary computer science teachers will be presented and feedback for refinement solicited. (Sponsored by ISTE)

General; Teachers, Technology Coordinators, Teacher Educators

BUILDING A LEARNING ENVIRONMENT

Language Arts/Social Studies

Postcard Geography: An Interdisciplinary Program That Integrates Social Studies and Technology

Jan Carr, Laurel School (OH)

Room: S405a

Postcard Geography is an interdisciplinary program that is integrated into the classroom curriculum. It uses technology to help students learn about U.S. and world geography.

K–8; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators

Math/Science

Digital Cameras Take a Hike: Enhancing Outdoor Experiences with Technology

Amy Gnack, Dakota Science Center (ND)

Room: S103b/c

Take environmental education to a new level. Learn how digital cameras can enrich real-world experiences through student-created multimedia projects.

K–6; Teachers, Teacher Educators; NETS•S: 3, 4, 5; NETS•T: ii, iii

Computer Science

Incorporating Social Issues and Career Preparation into the Computer Science Curriculum

Chris Stephenson, University of Waterloo (ON, Canada)

Room: S504b/c

Explore strategies for using social issues and career preparation to challenge high school computer students to consider new ideas and develop essential skills.

9–12, University/College; Teachers, Technology Coordinators

Multimedia/Virtual Reality

Meanwhile Back at the Ranch: Adapting Training to the Classroom Context

Betty Gaelz, Blackfoot School District (ID), Shane Moulton, Sheila Knox

Room: S104

Introduce yourself to a wide variety of practical ideas developed by Idaho teachers on how to effectively develop multimedia projects under different classroom conditions.

General; Teachers, Technology Coordinators, Staff Developers; NETS•S: 1, 3–5; NETS•T: ii, iii

Internet/Web

Dynamic Web Pages in Teaching and Administration

Helmut Doll, Bloomsburg University (PA)

Room: S505a/b

Would you like to manage your classroom presentations, handouts, and assignments from a distance? Dynamic Web sites and databases may be the answer.

University/College, Community College; Teachers, Technology Coordinators, Library/Media Specialists, Administrators

Use the Internet to Create Web-Based Activities

Sheila Gersh, City College of New York

Room: S103a

Learn to "Internetize" your traditional classroom lessons, create online collaborative projects, and create WebQuests that meet statewide learning standards and assessment criteria.

K–12; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators

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Communicate, Collaborate, Cool!

Margaret Hollies, Carmel Junior High School (IN), Madeline Fitzgerald, Jan Strobl, Christine Hodge, Jackie Morris, Julie Scott

Room: S103d

Teachers from Carmel Junior High are breaking down the classroom barriers and extending the learning process outside the regular school day with units of study.

4–12: Teachers, Technology Coordinators Library/Media Specialists, Administrators

Use the Web as a Space for Interdisciplinary Teaching

Anna Li, SERVE, Inc. (NC)

Room: S405b

Make the Web work for you! Learn instructional strategies and promising practices for using the Web as a viable tool for interdisciplinary teaching.

K–12: Teachers, Technology Coordinators, Staff Developers, Library/Media Specialists, Administrators

Elementary Internet-Based Activities and Brain Research: A Powerful Combination

Michelle Wrenn Benham, Capistrano Unified School District (CA), Kristen Nelson, Lynn Tabaz

Room: S404b/c

See an example of how a Web-based student activity can be designed using the most current brain research and centered around ISTE standards.

K–6; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Administrators; NETS•S: 3–5

Technology Integration

The Role of Information Technology in Putting Meaning Back into Formal Education

Oscar Becerra, Universidad San Ignacio de Loyola (Peru)

Room: S404d

With a constructivist approach, technology is a powerful source for the improvement of education. See how student involvement changes when they feel empowered by projects such as KIDLINK.

3–12; Teachers, Teacher Educators, Library/Media Specialists, Technology Coordinators/Administrators/Staff Developers; NETS•T: ii, iii

Technology Landscapes: Adapting to Changing Teaching and Learning Environments

Annette Lamb, Lamb Learning Group (TX)

Room: S102a

Climb the mountain of success with your technology projects by applying your knowledge of good teaching practice, adapting your current skills, and forming new relationships. (Sponsored by AECT)

General; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Library/Media Specialists, Administrators

The Engaged Classroom

Beverly Nasland, Center for the Application of Information Technologies (IL)

Room: S102b/c

Celebrate new ways of teaching and learning. This session provides an overview of a staff development program on the Engaged Learning Model. Learn how your school districts may benefit from this training resource.

Teachers, Teacher Educators, Library/Media Specialists, Technology Coordinators/Administrators/Staff Developers

The Past, the Present, and the Future Connected through Technology

Cyndy Thielen, Emmons Elementary School (IL), Cheryl McCameron, Kitty Wiegel

Room: S105a

Travel through time or fly through space. See how a small K–8 school journeys through the curriculum with technology.

General; Teachers, Technology Coordinators, Staff Developers

Instructional Strategies & Classroom Management with Technology

Linear or Branching: Which to Use and When?

Carol Brown, East Carolina University (NC)

Room: S100

Teachers are often confused about which software application to use for a particular teaching activity. Learn to choose your tools wisely.

General; Teachers, Teacher Educators, Staff Developers, Library/Media Specialists

Challenge Failure— A Formula for Success!

John Kramer, Point Pleasant District (MD)

Room: S402

Discover how a New Jersey school embraced technology to expand learning time and reinforce core skills to help their students pass high-stakes state and national tests.

6–12, Community College; Technology Coordinators, Administrators

Distance/Distributed Learning

Developing Online Learning Components: Analyzing the Process, Product, and Implementation

Constance Cassity, National-Louis University, Arlene Borthwick, Kate Zilla

Room: S101a

Share lessons learned from research on the development and implementation of online learning components in an interdisciplinary core course in a preservice MAT program.

University/College, Community College; Teacher Educators, Staff Developers, Administrators

High School Options: Online or Face-to-Face Instruction

Todd Taylor, Forest High School (FL), Scarlet Lake, Pat Rogers, Scott Peters, George Tonyn, Rhonda Avery Loretta Dalke, Rick Lankford

Room: S404a

Using their own staff to develop and deliver the curriculum, a central Florida high school offers online classes as well as traditional face-to-face instruction.

9–12: Teachers, Technology Coordinators, Staff Developers, Administrators

Laptops

W. E. L.E.A.P.—Wireless Environment Laptops Expand Academic Performance

Rebecca Elish, School Town of Highland (IN), Gary Eberhart

Room: S105b/c

How do you create a dynamic, challenging, nonrestrictive environment for students to learn? Use wireless laptop computers to provide learning anywhere and anytime.

K–8; Teachers, Technology Coordinators, Staff Developers, Administrators

PAPERS

Two papers per one-hour session.

Equal Internet Access: Making Connections across Divides

Janice Hinson, Louisiana State University, Cathy Daniel, Ken Royal (CT), Larry Parker, Sally Blanchard

Room: S504a

Examine changes in self-efficacy levels of fourth-grade students in language arts and technology when accessing the Internet through a cable television connection.

General; Teachers, Technology Coordinators, Teacher Educators, Staff Developers, Administrators

Commonalities in Educational Technology Policy Initiatives Among Nations

James Schultz, IBM (UT), Janet Azbell (IL)

Room: S504a

An analysis of commonalities in education technology reform initiatives among nations, the forces that have shaped the initiatives, and the need to address resultant lacunae.

General; Technology Coordinators, Teacher Educators, Staff Developers, Administrators

WEDNESDAY, 4:15–5 PM

CLOSING GIVEAWAYS & NECC 2002 PREVIEW

GENERAL SESSION HALL B1

Bring your conference evaluation and join us for a drawing of special prizes including PDA solutions from Palm, Inc.. If you've attended this session in past years, you know how much there is to win! More hardware, software, and an airfare/registration package for NECC 2002 will also be given away! Your completed evaluation form is your drawing ticket; you must be present and have photo ID to win. A preview of San Antonio's NECC 2002: Nexus in Texas will cap the event.

MAIN PRESENTERS FOR CONCURRENT SESSIONS, POSTERS, WEB POSTERS, STUDENT SHOWCASES, BIRDS-OF-A-FEATHER, AND KEYNOTES

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FUTURE NECCs

MARK YOUR CALENDARS AND PLAN AHEAD!

San Antonio, TX
"Nexus in Texas"
June 17–19, 2002

Seattle, WA
June 30–July 2, 2003
(limited registration available)

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Make & Take sessions are two hours long and have a hands-on component that results in participants leaving with a product such as a WebQuest, Web page, big book, or electronic presentation. The format is collaborative groups of three to a computer. If you preregistered for a Make & Take Session, check your badge ticket to find the room number. **Make & Take Sessions require preregistration and payment of a $10 fee. Check On-Site Registration for availability of these sessions.**

PARTICIPANTS WILL GET A ZIP DISK TO TAKE HOME THEIR CLASS PROJECTS!

MONDAY MORNING, JUNE 25

10 am–12 noon

Design Technology Integration Projects for Elementary Social Studies Students
Jeri Carroll, with Brenda Vague, Lori Schock, and Tonya Witherspoon

Use the Web Features of Microsoft® Office 2000
Jane Davis

Quilting through the Year with Technology
Karen Roark

TaskStream: Tools of Engagement
Malcolm Thompson and Risa Sackman

MONDAY AFTERNOON, JUNE 25

1:30–3:30 pm

PowerPoint® for Critical Thinking
Josh Braun

Create Learning Journeys for the Web!
Deborah Gray, Nancy Lane

A Classroom Tool for All Ages That Can't Be Beat
Deborah Hale

Create Web-Based Online Surveys
Jeff Sun and Lara Buchko

TUESDAY MORNING, JUNE 26

10 am–12 noon

MUVEs for the Classroom
Amy Bruckman

Successful Profiling as a Model for Student Self-Assessment
Cheryl Rodgers

Out with the Students: Access Your Classroom's Fullest Potential
Meredith Kaltman, with Zena Brown and Alysse Jones

TUESDAY AFTERNOON, JUNE 26

1:30–3:30 pm

Create a Web-Based Unit
Jennifer Hey-Lewis and Tenesha Hatter

Create a Web Photo Album
Kirsti Aho

Developing Learning-Centered School Libraries
Donna Steffan and Deb Wolff

Sinking in a Sea of Standards: Technology and Student Achievement
Colleen Souza and Bryan Souza

WEDNESDAY MORNING, JUNE 27

10 am–12 noon

Create the Appropriate Technology Rubric
Linda Bloom

Create a Digital Video for Your School Web Site
Karen Percak, with Carl Owens, Anthony Robinson, Bruce Ahlborn, Ken Wiseman, Robert Hudson, Jacque Havice, and Charles Hagan

Close the Digital Divide: Build an Online Community in Your School
Peter Watson

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INTERESTED IN TAKING A WORKSHOP?

Seats may still be available at On-Site Registration. Additional fees apply.

Half-Day (3 hrs)	$80
Full-Day (6 hrs)	$160*
Two-Day (12 hrs)	$320*

* *Includes box lunch.*

MORNING WORKSHOPS
8:30–11:30 am

AFTERNOON WORKSHOPS
1:30–4:30 pm

FULL-DAY WORKSHOPS
9 am–4 pm

TWO-DAY WORKSHOPS
9 am–4 pm
Saturday & Sunday

iste *NECC 2001 Workshops are organized and operated by ISTE (International Society for Technology in Education). More information about how ISTE connects educators worldwide to dependable resources can be found on the ISTE Web site at www.iste.org.*

WORKSHOP LOCATION KEY

Rooms NXXX or SXXX = **McCormick Place Convention Center**

Medill = **Medill Technical and Professional Development Center**
1326 W. 14th Place, Chicago, IL 60608-2106

Payton = **Walter Payton College Prepatory High School**
1034 N. Wells Street, Chicago, IL 60610-2529

Fermilab = **Fermi National Accelerator Laboratory**
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Evanston HS = **Evanston Township High School**
1600 Dodge Avenue, Evanston, IL 60204

IMPORTANT! Parking is not readily available at off-site workshop facilities, particularly on weekdays when Summer School is in session. Participants are strongly urged to take workshop shuttles. **NECC WILL NOT BE RESPONSIBLE FOR WORKSHOPS MISSED DUE TO UNAVAILABILITY OF PARKING.**

Off-site workshop locations do not offer availability or access to food or beverages (including coffee). Participants are advised to plan accordingly. Box lunches are provided for full-day and two-day workshop participants.

WORKSHOP TRANSPORTATION

Transportation is provided to all off-site workshops. Buses will depart from and return to McCormick Place Convention Center at Gates 2–3 outside the 100 level meeting rooms in the South Building. Please check below for your workshop's exact bus departure time.

IMPORTANT! All workshop transportation, except field trips, is by shuttle. You do not need to catch a specific bus. Simply take the next available bus to your workshop location. Workshop shuttles commence one hour before workshop start time and depart approximately every 5–10 minutes until the last shuttle. Estimated travel time is 20–30 minutes, depending on traffic. **TRANSPORTATION WILL NOT BE PROVIDED FOR PARTICIPANTS WHO MISS THEIR BUSES.**

OFF-SITE WORKSHOP BUS SCHEDULE

Workshops	**Destination**	**1st Shuttle**	**Last Shuttle**
Morning	Medill or Payton	7:30 am	8 am
Full- & Two-Day	Medill or Payton	8 am	8:30 am
Afternoon	Medill or Payton	12:30 pm	1 pm

Field Trip Workshops	**Destination**	**1st Shuttle**	**Last Shuttle**
SUF324	Fermilab	8 am	N/A
SUF340	Evanston HS	8 am	N/A

SATURDAY & SUNDAY TWO-DAY WORKSHOPS, JUNE 23–24

CODE	TITLE	MAIN PRESENTER	LOCATION
SSF101	Teacher Leader Academy: A Successful Design for Technology	Charlene Pope	N427d
SSF102	Dreamweaver® Designs with an Introduction to Coursebuilder ...	Lucianne Sweder	N427b/c

SATURDAY MORNING WORKSHOPS, JUNE 23

SAA200	Technology Planning: Secrets for Evaluating and Revising...	Larry Anderson	S404b/c
SAA201	Electronic Portfolios = Multimedia Skills + Portfolio Development	Helen Barrett	S404d
SAA202	The Eureka! Experience: Get the Most Out of Internet Searching	Bruce Macdonald	S404a
SAA204	MeasureIt! Tools and Strategies for Gauging the Impact of Technology	Kirk Vandersall	S501d
SAA205	Legal and Responsible Use of the Internet: Educators' Responsibilities	Nancy Willard	S501b/c

SATURDAY FULL-DAY WORKSHOPS, JUNE 23

SAF213	Create E-paper with Adobe® Acrobat®	Steve Adler	Payton 308
SAF214	Internet Information Fluency: Locate, Evaluate, and Integrate ...	David Barr	Medill 105
SAF215	Using GIS as a Problem-Solving Tool	Mary Burns	Payton 208
SAF216	Pictures Are Worth 1,000 Words: Integrating Digital Cameras	Paul Nelson	Medill 109
SAF217	Go Anywhere Multimedia: Digital Cameras in the Classroom	Mark Delano	Medill 200
SAF218	Reality-Based Learning: Combine Curriculum, Technology...	Joyce Fitch	S405b
SAF219	3-D Graphics and 4-D Animations Kids Love to Learn	Bob Frazier	Payton 114
SAF220	Beyond the Basics: Discover "Integrated" Technology	Juanita Guerin	Payton 212
SAF221	Use Multimedia to Engage Students in Education	Don Henderson	N427a
SAF222	Build a Database-Driven Web Site with FrontPage®	Joe Hogan	Medill 107
SAF223	Plan for Success: Align Technology Planning ...	Ian Jukes	S405a
SAF226	My Hammer Isia Video Camera: Digital Video as a Tool	Tim Merritt	Payton 310
SAF227	Creating Web-Based Curriculum	Tammy Payton	Payton 110
SAF230	Create a Thinking Curriculum	Sharon Sutton	Payton 210
SAF231	The Director in the Classroom: Desktop Movies	Nikos Theodosakis	Payton 312
SAF232	Online Professional Development	Barbara Treacy	Payton 112
SAF233	Animation with the Hyperanimaniacs	Kate Vanderhorst	Medill 304
SAF235	Teach Computer Science Using Java	Tom West	Payton 314

SATURDAY AFTERNOON WORKSHOPS, JUNE 23

SAP207	Technology Policy: Keep Your School—and Yourself—Out of Trouble	Larry Anderson	S404b/c
SAP208	DVD Video: Seamless Curriculum Integration Today!	Ann Cunningham	S501b/c
SAP210	Stuck in the Mud: Bridge the Technology Knowing-Doing Gap	Annette Lamb	S404d
SAP212	Texas Statewide Leadership Academy, a Bill Gates Foundation Project	Alice Miller	S501d

SUNDAY MORNING WORKSHOPS, JUNE 24

SUA300	Design and Guide Online Courses	Gina Amenta-Shin	N427a
SUA301	PowerPoint® for Critical Thinking	Josh Braun	Payton 314
SUA302	Urban Students Bridge the Gap thrTugh Content-Based ...	Maria Fico	S404a
SUA303	Open a Can of Worms: Manage Technology-Rich, Engaged...	Annette Lamb	S404d
SUA304	All Kids Can Write	Terry Lankutis	S504b/c
SUA305	Staff Development Theme Park	Shelley Nordick	S404b/c
SUA306	Smart Buildings: How Do We Get There?	Craig Williams	S504a

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SUNDAY FULL-DAY WORKSHOPS, JUNE 24

SUF313	Hollywood Goes to School! Digital Video for Your Classroom	Larry Anderson	Payton 310
SUF315	Create Your Own Electronic Teaching Portfolio	Helen Barrett	Payton 212
SUF316	Web-Based Science and Math Visualization and Modeling	Lisa Bienvenue	Medill 109
SUF317	Technology Coordinators: Cope, Thrive, and Share	Willis Binnard	S501a
SUF319	Video Projects acAoss the Curriculum	Floyd Braid	S505a/b
SUF321	Technology Grantseeker's Toolkit	Gary Carnow	S405b
SUF323	Enhance Your Course Using WebCT	Chris Clark	Payton 208
SUF324	Studying Fundamental Particles of Matter: A Visit to Fermi...	Susan Dahl	Fermilab
SUF325	HyperLogo Scripting—The Second Mile of HyperStudio	Chuck Friesen	Medill 304
SUF326	Staff Development for Technology and Engaged Learning	Sharon Gatz	Payton 312
SUF328	Use Technology to Teach Social Studies	Lori Krane	Payton 110
SUF329	Scripting Roles for Everyone in the Development of Your Web Site	Kirk Langer	Payton 308
SUF332	New Visions for Teaching and Learning in the 21st Century	Ted McCain	S405a
SUF333	Building Database-Backed Web Sites with FrontPage 2000	Todd McIntire	Payton 112
SUF334	Classroom Integration of the Internet	Tammy Payton	Payton 114
SUF335	The Classroom and Beyond: Integrating Handheld PCs and Digital...	Gregory Peck	Medill 200
SUF336	Technology Accountability: Should We Unplug Our Expectations...	Bernajoan Porter	S501d
SUF337	Use Microsoft FrontPage to Create a Class Web Site	Microsoft Staff	S401b/c
SUF339	Technology Training in Preservice Teacher Education	Sharon Yoder	S501b/c
SUF340	Logosium 2001 Conference and Social Dinner	Gary Stager	Evanston HS

SUNDAY AFTERNOON WORKSHOPS, JUNE 24

SUP307	Dynamic Use of an Interactive Network for Education...	Anne Allen	S404d
SUP308	Integrate Technology into the 6–12 English Classroom	Ann Bjorklund	S404a
SUP309	Active Learning with Technology: Learner-Centered...	Jackie Burniske	S404b/c
SUP310	K–2: What's Online for You?	Gail Lovely	S504b/c
SUP311	Build Switched Multipurpose Gigabit School Networks	John Mundt	S504a
SUP312	PageMaker 6.5: Using It to Make a Difference	Rae Niles	N427a
SUP342	Think Wireless	Marc Long	S504d

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MONDAY MORNING WORKSHOPS, JUNE 25

MA400	Inspirational Science	Danielle Abernethy	Medill 105
MA401	The Art of Collaboration: Awesome Tools and Proven Strategies	Yvonne Marie Andres	Medill 201
MA402	Effective Use of Assessment in Staff Development	Linda Bloom	Payton 312
MA403	Student Internet Use: Best Practices	Nancy Bosch	Payton 218
MA404	Adobe Acrobat 4.0: The New, Cool Tool for the New, Cool Classroom ...	Barrie Cole	Medill 107
MA405	Beyond the Textbook: Technology in Social Studies	Scott DeWitt	Payton 210
MA407	E-folios	Bruce Elliott	Payton 308
MA408	Inspire Creativity for Presentations and Projects by Teachers...	Leslie Flanders	N427d
MA409	Video Webcasting in Less Than a Day!	Jayne James	Payton 310
MA410	Image Processing Curricula for Science and Math	Bob Kolvoord	Medill 200
MA411	Effortless Video Editing for Educators	Keith Mack	Payton 114
MA412	Increase Student Engagement and Communication Skills...	Apple Team	N427a
MA413	A River in Trouble—Engaged Learning, Writing, and Thinking...	Jamie McKenzie	N427b/c
MA414	Create Your Online Class Using Blackboard	Tina Mondale	Payton 212
MA415	It's Elementary! Research Strategies for the Internet-Overwhelmed	Samantha Morra	Medill 304
MA416	Build a Better PowerPoint Presentation	Judith Parham	Payton 110
MA417	Microsoft FrontPage 2000: Designing Web Pages	Anne Rock	Medill 109
MA418	Custom Graphics for Beginners	Susan Silverman	Payton 116
MA420	Manage Microsoft Office Applications for Learning Success...	Microsoft Staff	S401b/c
MA421	Hyperlinking Narrative: Writing in the Third Dimension	Nancy Sulla	Payton 208
MA423	Organizing Good Ideas with Inspiration	Leigh Zeitz	Payton 112
MA449	Using Palm Computers in the Classroom	John Hilliard	Payton 314
MA450	Putting Databases on the Web with FileMaker™ Pro 5	Leslie Fisher	Payton 220

MONDAY AFTERNOON WORKSHOPS, JUNE 25

MP424	Inspirational Math	Danielle Abernethy	Medill 107
MP426	Project-Based Learning and Multimedia	Diann Boehm	Payton 308
MP427	Integrate Technology into the Curriculum	Sherry Bushre	Medill 109
MP428	Use the Internet from A to Z	Jackie Carrigan	Payton 110
MP429	PowerPoint —How Can I Use It In My Classroom?	Janet Caughlin	Payton 218
MP430	Patterns for WebQuest Design	Bernie Dodge	N427b/c
MP432	Student Web Pages: Evidence of Knowledge and Skills	Steve Huff	Payton 116
MP433	Leap into Literacy: A Multisensory Approach to Teaching Reading	Trish Svaib	Payton 208
MP434	Editing Multimedia with QuickTime™ Pro	Patsy Lanclos	Payton 312
MP436	iTools at Your Service! A Powerful Toolbox of Internet Resources...	Apple Team	N427a
MP437	Implementing ISTE NETS•S and NETS•T into the Social Studies...	D. Mark Meyers	Payton 210
MP438	Get Wireless	Kathy Miller	N427d
MP439	Desktop Movies and Student Empowerment: A Winning Combination	Rae Niles	Payton 310
MP440	Use Data to Plan Responsive Staff Development	Amy Pearl	Medill 105
MP441	Design Effective Online Learning	Linda Ross	Payton 314
MP442	Mine the Internet for Nuggets to Enrich Your Elementary Classroom!	Susan Silverman	Payton 212
MP443	Design a Gradebook with Microsoft Excel	Microsoft Staff	S401b/c
MP446	Digital Portfolios: For the Professional Educator	Kate Thompson	Payton 114
MP447	Make Math, Science, and Technology Meaningful	Tonya Witherspoon	Medill 201
MP448	Create Quality IEPs Fast, Report Progress, and Ensure IDEA Compliance	Cathy Zier	Medill 200
MP451	Photoshop 6, What's New?	Leslie Fisher	Payton 220

TUESDAY MORNING WORKSHOPS, JUNE 26

TA500	Donna and Nancy's Excellent AppleWorks' Adventure	Donna Archibald	N427d
TA501	A Bird's Eye View: Use Technology to Visualize Social Studies	Linda Bennett	Payton 114
TA502	You, Too, Can Learn to Use Word!	Janet Caughlin	Payton 218
TA503	enGauge: A Framework for Effective Technology Use in Schools	Kristin Ciesemier	Payton 210
TA506	Help Students Create Powerful PowerPoint' Presentations	Paul Gardner	Payton 208
TA507	Using NASA Resources to Explore PBL	Nitin Naik	Medill 200
TA508	A Computer for Every Student! (And It Speaks!)	Andrew Kramer	Payton 112
TA509	21st Century Solutions for Hands-on Science	Tom Kuhn	Payton 116
TA510	Let's Compose a Web Page with Composer	Patsy Lanclos	Payton 312
TA511	Create Your Own Professional Development Videos: Desktop Movies...	Apple' Team	N427a
TA512	PowerLearning: Creating Student-Centered, Problem-Based...	Jamie McKenzie	N427b/c
TA516	Creating iMovies to Enhance Student Learning	Howard Pitler	Payton 310
TA518	Introduction to Macromedia' Flash™!	Macromedia Staff	Medill 107
TA519	The New HyperStudio': A Multimedia Thinking Tool for Interactive...	Ana-Maria Schwartz	Medill 109
TA520	Teach Language Skills with Microsoft' Word	Microsoft Staff	S401b/c
TA521	Authentic Research in the Classroom	Phyllis Starrett-Tuttle	Payton 212
TA523	URLs 24/7	Helen Teague	Payton 314
TA524	e-Power Portfolio: Online Tools for Assessment, Portfolio, and Career ...	Rick Van Den Bossche	Payton 110

TUESDAY AFTERNOON WORKSHOPS, JUNE 26

TP526	Virtual Reality acrAss the Disciplines	Brenda Gerber	Payton 310
TP527	Electronic Portfolios for Teachers and Students	Nancy Becker	Payton 110
TP528	Integrate a Multidisciplinary Environment into a Monodisciplinary ...	Linda Bloom	Payton 116
TP529	INTECH: A Fail-Safe Model for Technology Integration	Melody Bonnette	N427b/c
TP530	Best Practices for Little Guys Using the Internet	Nancy Bosch	Payton 112
TP531	Interactive, Dynamic Education Web Sites	Teresa Bromley	Medill 107
TP532	PowerPoint' as a Tool for Developing Tutorials	Sister Cummings	Payton 218
TP533	Training Matters: Technology Infusion Planning	MaryBeth Cunat	Medill 109
TP534	Power Learning with Inspiration': Computer-Based Study Strategies	Mary Ditson	N427d
TP535	Teach 3-D Graphics Kids Love to Learn	Bob Frazier	Medill 200
TP538	Dazzling Publications with Microsoft' Publisher	Barbara Hogan	Payton 314
TP539	Computer-Control/Robotics Technology in the Science or Technology ...	Robert Jesberg	Payton 308
TP540	WebQuests: Taming the Wild, Wild Web!	Pamela Kuck	Payton 220
TP541	Build a Project-Based, Problem-Solving Mathematics Learning...	Diane Mason	Medill 105
TP542	Secure Your Windows Computers Using System Policies	Larry McHaney	Medill 201
TP543	Palmtop Technology for the Administrator and Educator	James Mitchell	Payton 114
TP544	Create Web-Based Projects and Activities with Microsoft' Office	Tina Mondale	Payton 212
TP548	Manage Student Information and School Data	Microsoft Staff	S401b/c
TP549	WWWAUDIO and WWWVIDEO: Streaming Web-Based Student ...	Gary Stager	Payton 312
TP551	Create Virtual Environments with QuickTime™ VR	Michael Wininger	N427a

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SEATS MAY STILL BE AVAILABLE— CHECK AT ON-SITE REGISTRATION.

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> *Thank you to each of the dedicated professionals and their families for the long hours and irreplaceable knowledge and expertise they have given to NECC 2001. NECC relies on its volunteer committee members each year, and without their commitment and professional interest in giving back to the field of educational technology, we would not be able to bring you such an outstanding conference.*
>
> *–Cathleen Norris, NECA President*

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__NECA's mission__ is to advance educational philosophies, practices, policies, and research that focus on the appropriate use of current and emerging technologies to reach their full potential. The primary vehicle is NECC, an annual conference for those interested in improving teaching and learning with technology in K-12 and teacher education.

We've seen the future
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notes...

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BUILDING ON THE FUTURE

WELCOME TO CHICAGO AND THE 22ND ANNUAL NATIONAL EDUCATIONAL COMPUTING CONFERENCE...

WWW.NECCSITE.ORG

Our volunteer committee has been hard at work since 1999, building this conference for your education, exploration, and enjoyment—we hope you're ready to roll up your sleeves and take advantage of all NECC 2001 has to offer.

Inspiring speakers, stimulating workshops, a massive network of educational professionals, the biggest international technology exhibit in the world, and more than 20 years of conference experience guarantee that your time at NECC 2001 will be well spent.

The number of exciting events we have planned for you is extensive and at times even overwhelming. We're so thrilled to have all of these options for you and encourage you to attend our Newcomers' Session (whether you're new or not!) and read carefully through all the details that this program contains. Chicago and NECC will be at its best for you this week, and we encourage you to sample as much as you can.

The foundation of education in the Information Age is being built this very moment—see you in the construction zone!

Guy Ballard
and Bonnie Thurber,
NECC 2001 Co-chairs

NECC 2001 KEYNOTES ARE...

STEVE JOBS
JANIECE WEBB
JOHN STUPKA
HILARIE DAVIS
DEBBIE SILVER

CONFERENCE BLUEPRINT

NECC comprises an incredibly rich mix of hands-on, lecture-style, and showcase sessions, along with exhibits, networking, and social opportunities. To get the most out of your NECC experience, we suggest that you:

1. Attend one of the Newcomers' sessions to get a conference overview.
2. Divide and conquer. If you're with a team of folks, agree on what you collectively want to cover and split up. What great dinnertime conversation!
3. Get familiar with the contents of your registration bag and the floor plans of McCormick Place. The Final Program and the mini-matrix of conference sessions will be invaluable guides, as will the daily conference newsletter (available Monday–Wednesday).
4. Use the online conference scheduler to plan your learning, networking, play, and social time (see below for details).
5. Plan ahead for your transportation needs and pick up a copy of the official shuttle schedule from your hotel or the NECC 2001 Info Booth—all hotels except the Hyatt McCormick Place require shuttle or cab transportation.
6. Wear comfortable shoes, and don't hesitate to ask questions. We'll have volunteer greeters and info guides located throughout McCormick Place—look for the "Ask Me" signs!

CONFERENCE SCHEDULER

We are excited to provide attendees with an online conference planner, sponsored by *T.H.E. Journal*. The planner is available exclusively at www.neccsite.org—use one of our 200 e-mail stations or your own machine to plot your daily activities at NECC. You can choose from Workshops, Keynotes, tours, social events, Birds-of-a-Feather Sessions, Concurrent Sessions, Poster and Web Poster sessions, Student Showcases, Research Papers, and Make & Takes. By establishing a personal log-in ID and saving to the scheduler site, you can maintain and change your schedule as often as you like. You can print out copies of it from any of the on-site e-mail stations. There is one printer for every 10 stations.

HANDHELD DEVICES...

For those using handheld devices [illegible] Palm OS, the Palm [illegible] of the NECC 2001 schedule [illegible] be [illegible] at the NECC [illegible] [illegible] at the Palm booth and at the NECC Info Booth.

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Conference Facts

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NECC 2001/NECA CONTACTS

Press Contacts:

Jessica Cole
NECC 2001 Media Relations
ISTE
541.302.0952

Brian Nolan
NECC 2001 Media Relations
Niles Township High School District 219
847.568.3957

Other conference contacts.

Background
With its sessions, symposia, exhibitors, and registered attendees, the National Educational Computing Conference (NECC) is the largest conference of its kind in the world. NECC has been providing K-12 and university-level education professionals with an annual forum to learn, exchange, and survey advancements in the field of educational technology for more than 20 years.

Through preconference hands-on and discussion-based workshops, lectures and interactive sessions, discussions with key industry speakers, and the largest vendor exhibition of its kind, participants have the unique opportunity to discover and share what they need to develop the appropriate use of technology in their classrooms, districts, and universities.

NECC is sponsored each year by the National Educational Computing Association (NECA) and is hosted by one or more local institutions such as a university or nonprofit educational organization. Previous NECCs have been held in Atlanta, Georgia (2000); Atlantic City, New Jersey (1999); San Diego, California (1998); and Seattle, Washington (1997). NECC 2001 will be held at McCormick Place in Chicago, IL, June 25-27, 2001.

NECC 2001 is hosted by the Illinois Computer Educators (ICE) and the School of Education and Social Policy, Northwestern University, in cooperation with the Chicago Public Schools, Illinois State Board of Education, Illinois State Learning Technology Centers, Niles Township High School District 219, NCRTEC at the North Central Regional Educational Laboratory (NCREL), the Collaboratory Project (Northwestern University), and the Illinois Educational Technology Council. The conference is co-chaired by Niles Township High School District 219 Technology Director Guy Ballard and The Collaboratory Project Director Bonnie Thurber. In addition to NECC 2001's connection with its hosts, the conference is also dependent on more than 1,500 area volunteers and the support of school districts and educational associations throughout Illinois and the rest of the United States.

NECC 2001 Highlights

- Keynote Sessions by Steve Jobs (CEO, Apple); Janiece Webb (Senior Vice President, Internet Software and Content Group, Motorola, Inc.) and John Stupka (President, Wireless Solutions and Ventures and Alliances, WorldCom); Hilarie Davis and colleagues (Technology for Learning Consortium); and Debbie Silver (Director, Technology Based Learning)
- Featured Spotlight Sessions by Donna Baumbach, David Dwyer, Dennis Harper, Ian Jukes, Cheryl Lemke, Ted McCain, Jamie McKenzie, Bernajean Porter, Al Rogers, David Thornburg, Cheryl Vedoe, and more
- Student Showcase featuring technology projects and students of all levels and areas of education
- International Reception where international attendees can network and share global experiences on integrating technology into the learning experience
- More than 180 hands-on, activity-based, and demo/lecture format workshops facilitated and organized by ISTE, the International Society for Technology in Education
- The largest national technology in education exhibit in the world‹more than 400 exhibiting companies and 1,400 booths

NECA Leadership
Leadership of NECA is provided by an elected board of directors, a management office, and representatives of the following not-for-profit educational and technical societies:

- International Society for Technology in Education (ISTE)
- ISTE Special Interest Group for

Technology Coordinators (SIGTC)
- ISTE Special Interest Group for Teacher Educators (SIGTE)
- American Associations for Higher Education/TLT Group (AAHE/TLT Group)
- ACM* Special Interest Group on Computers and Society (SIGCAS)
- ACM* Special Interest Group on Computer Science Education (SIGCSE)
- Computer Uses in Education (SIGCUE)
- University and College Computing Services (SIGUCCS)
- Association for Educational Communications and Technology (AECT)
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- EDUCAUSE
- IEEE Computer Society
- Society for Computer Simulation (SCS)

* Association for Computing Machinery

Press Information

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Thank you for your interest in NECC 2001. We sincerely hope that it was a successful and productive time for all who attended.

Post-Conference Facts

- Final conference attendance, as of Wednesday, June 27: 13,573, plus an additional 4,577 exhibitor representatives.
- Steve Jobs (CEO, Apple) spoke to a crowd of approximately 9,500 persons in the opening keynote at 8:30 am on Monday, June 25.
- 449 companies covered 1,333 10' X 10' booths (133,300 net sq ft of exhibit space) in Exhibit Hall A1, McCormick Place, 2301 South Martin Luther King Drive, Chicago, IL.
- 542 sessions provided professional development in four primary and 17 sub-themes.
- 143 workshops were full to standing room only. (Total workshop attendance: 4,422.)

If your coverage of NECC 2001 resulted in a news piece, we would like to see it.

If you are willing and able, please send instructions for obtaining a clipping (URL or publication name/date) to: jcole@iste.org

Thank you in advance.

Contact us:
Jessica Cole
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The following information pertains to NECC 2001. For information on next year's conference, please visit our NECC 2002 site.

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NECC is the largest national educational conference for K-16 educators, administrators, and technology coordinators in the United States. This 22nd annual NECC is sponsored by the National Educational Computing Association (NECA), Inc. NECC 2001 will be hosted by the Illinois Computing Educators (ICE) and Northwestern University in cooperation with Chicago Public Schools, the Illinois State Board of Education, Illinois State Learning Technology Hubs, Niles Township High School District and NCRTEC at NCREL.

NECC began in 1979 as an event held to bring together members from a variety of professional societies that make up NECA, and continues to grow as the primary national conference for educators from preschool to grad school. We are proud to greet each attendee with unparalleled professional development opportunities through NECC's wide array of concurrent sessions, workshops, keynote speakers, and exhibits. The National Educational Computing Conference (NECC) is the place to reach decision-makers in the field of technology in education. Each year, NECC creates unique marketing opportunities for a large and enthusiastic audience that your company can reach through sponsorship. We invite you to consider sponsoring an event singly or cosponsoring with another business. We also invite you to use your imagination and bring us your suggestions for additional opportunities.

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☐ 006 Technology Accountability: Should We Unplug Our Expectations for Student Results? by Porter

☐ 007 New Horizons: From Gutenberg to Gates and Beyond by McCain & Jukes

☐ 009 Tech Savvy: Funding for K–12 Technology Education Programs by Jordan-Meldrum

MONDAY • JUNE 25, 2001 • CONTINUED

☐ 010 A Different and Better Way of "Doing School" by Whitworth

☐ 011 Early Literacy and Technology: Positively Impacting Student Achievement by Chambers

☐ 012 Academic Standards and Technology in Plain English by Garrigan

☐ 013 Teaching with Java: The Good, the Bad, and the Opportunity by West

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☐ 018 A Richer Picture: Digital Portfolios for Students and Teachers by Niguidula

☐ 019 Get Wired! Create an Integrated Learning Environment with ASP Technology by Kostyniak

☐ 022 Teach Real-World Skills in a Multi-user Virtual Environment by Dede & Ruess

☐ 023 Generation YES—The Center for Student-Centered Reform by Harper & Cairns

☐ 024 Global SchoolNet Shared Learning Teacher Award by Rogers & Andres

☐ 025 Computer, Heal Thyself! Version 2: The Technology Umbrella Theory by Houser, Applegate & Posey

☐ 026 Curriculum and Technology: Connections by Design by Hofreuter

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☐ 028 Technology Best Practice through Staff Self-Assessment by Moore, West & Bartolac

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☐ 029 Stop the Madness: Use the Web to Bring Accountability to Standardized Testing by Polin, Stager, Ohanian, Thornburg & Schmidt

☐ 030 Learning Tomorrow's Way Today: Beyond Technology Integration by Pedwell

☐ 031 Digital Video Strategies for Authentic Assessment by Morgan & Thygeson

☐ 032 Web-Based Learning: America's Educators Speak to Congress by Anderson, Kerrey, Abraham, McGinn, Gowen, Fulton & Vaille

☐ 034 Palm-Sized Computers in K–12: Experiences from the Field by Soloway, Norris, Mitchell & Tinker

☐ 035 Captured Wisdom: A Dialogue about Best Practices in the Use of Technology for Teaching and Learning by Ciesemier & Clifford

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☐ 039 Show Me the Money! by Lankutis

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☐ 043 Web-Based Integrated Science Environment (WISE): Inquiry for Lifelong Learning by Linn & Slotta

☐ 044 Will You Have a Job in 2010? by Wolinsky & Serim

TUESDAY • JUNE 26, 2001

☐ 0K2 Keynote: Touching Tomorrow Today: A Practical Look at Future Technologies by Janiece Webb & John Strupka

☐ 045 Updating the Searching Toolkit by Valenza

☐ 046 Build a Community of Learners to Support Faculty and Students by Pierson, Anderson, Borthwick, Morris, Buckland-Parker

☐ 047 The Power of Multimedia by Mills, L. & Mills, S.

☐ 048 Tools for School Renewal: Delivering Data to the Desktop by Ochs, Cone & Johnson

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☐ 051 Environmental Science with GIS: Science, Geography, and Technology Standards by Edelson, Lach, Schwille, Siciliano & Tarnoff

☐ 052 Technology-Based Learning That Works! by Coughlin & Lemke

☐ 054 Illinois NextSteps: Scaling Up Statewide Technology Assessment by Dewitt, Ciesemier & Porter

☐ 056 School Web Pages: Advice from Student Designers by Maurer, Hill & Goben

☐ 057 SOS: (High School) Students Offering Support by Fry, Laytham & Sak

☐ 058 Technology in a Toolbox by Stritt

☐ 059 Technology Coordinators' Survival Kit by Landeck, Prouty & Bray

☐ 062 Integrate Technology into the Classroom: Skills Teachers Need to Be Successful by Doherty, Nolan, Candau, Yost, Somera & Judge

☐ 063 Enabling Education through the Next Generation Internet by Mambretti

☐ 064 Best Practices for Professional Development Providers by Heath & Burniske

☐ 065 Technology Leadership Training for School Administrators: Lessons Learned by Cory, Soule & Belitzky

☐ 066 Ignite and Invite Student High Performance in a Digital Age by Darnell

☐ 067 Internet Tools for Teaching Electronic Information Literacy Skills by Raker & Callan

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TUESDAY • JUNE 26, 2001 • CONTINUED

☐ 068 Integrate Technology and Reading Instruction to Improve Reading Achievement by Movall & Galbraith

☐ 070 Effective Management and Instructional Strategies for the One-Computer Classroom by LeMoine

☐ 071 Understand and Use Streaming Video by Pickett

☐ 072 WebQuests in the Computer Science Classroom by Peterson & Groves

☐ 073 enGauge: A Knowledge Base, An Online Assessment, and Proven Resources by Lemke & Valdez

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☐ 075 Going Thin by Huber

☐ 076 Teaching Interdisciplinary Problem Solving: Professional Development Models and Curriculum Resources by Chessler & Carroll

☐ 077 Hitch a Ride on a Satellite: GPS in the Classroom by Ninno & Kuhl

☐ 078 An Innovative Approach to Creating Web-Enabled Teachers by Sweet

☐ 079 Constructivism and Online Communities by Bruckman

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☐ 082 NASA's Education Portal—Your Cyber Gateway to NASA Involvement by Wild

☐ 083 Information Literacy in the Internet Age: A Progress Report by Abramson & Fornshell

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☐ 085 Andragogy and Technology by Matthew, Callaway & Letendre

☐ 086 Connect Technology and School Improvement: Project-Based Learning in the Classroom by Schmidt, Milner, Murphy, Michelini & Versteeg

☐ 087 Use Technology to Differentiate Instruction by White & Fisher

☐ 088 Technology-Intensive, Standards-Based, Middle School Mathematics Curricula by Reese

☐ 089 ISTE NETS for Teachers: Identifying Performance-Based Assessment Measures by Thomas, Barrett, Ropp & Daniell

☐ 090 The Snapshot Survey Service: Make Informed Decisions about Professional Development by Soloway & Norris

WEDNESDAY • JUNE 27, 2001

☐ 0K3 Keynote: Stories from the Field: Building the Wisdom of the Community by Hilarie Davis, Angela Cristini, Kathy Conway, Nan Lombardo, Alexsis Moran, Deborah Peek-Brown & Edie Thayer

☐ 0K4 Keynote: Going Outside the Lines by Debbie Silver

☐ 091 Cyber Learning and Student Achievement: An eSchool Model by McMahan, Holland & Cranmer

☐ 092 Spin the SEIR*TEC Professional Development Wheel for Successful Technology Integration by Bingham & Byrom

☐ 093 Pedagogical Readiness for a Laptop Environment by Giddings, Betts & Broyles

☐ 094 Which Is Better ... Screen A or Screen B? by Wallace,T. & Wallace, M.

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☐ 106 Assuring Quality in Learning Technology Assessment by Vandersall

☐ 107 The Online Professional Development Market: How Stocked Are Your Shelves? by James

☐ 108 A Range of Use by Lemke & Coughlin

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☐ 109 Overcome the Digital Divide by Luigart, Barrett, Koudry & Tozzi

☐ 110 Supporting School-Based Learning and Teaching with Advanced Visualization Technologies by Moher, Baez, Dudzik & Rothstein

☐ 111 Construct Fun and Educational Technology Activities with the K–6 Curriculum by Judd

☐ 112 Blazing Learning Trails: A Professional Development Model to Improve Schools by Harp, Bequette & Patterson-Dreyer

☐ 113 Use Technology Tools to Guide Student Research Projects by Stephens

☐ 114 Panoramic Pi … The Melding of Math and Multimedia by Hunsinger-Hoff & Chauveau

☐ 115 Technology Creates Enthusiasm for Reading! by Yohe

☐ 116 Integrate Technology into Learning Communities: Creating Multiple Workspaces by Shelly & Tinto

☐ 117 Assess the Use of Technology in the Classroom by DeWert, Cunningham, Strudler, Niederhauser, Chapman & McNabb

☐ 118 Windows to the World: Teaching and Learning at a Distance by Lamb

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☐ 120 Meanwhile Back at the Ranch: Adapting Training to the Classroom Context by Goeltz , Moulton & Knox

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☐ 123 Digital Cameras Take a Hike: Enhancing Outdoor Experiences with Technology by Grack

☐ 124 Use the Internet to Create Web-Based Activities by Gersh

☐ 125 Use the Web as a Space for Interdisciplinary Teaching by Li

☐ 126 Embedded Technology: Learning about and with Technology within Everyday Curriculum by Joseph, Bryk, Hoffman, Bradley, Djikas, Rietschel-Folkening, Greyer & Whitcomb

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